IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS & INTERFERENCES

APPLICATION NO.	:	10/651,583
APPLICANT	:	TOPP, Daniel P.
TITLE	:	APPARATUS FOR ERADICATING PESTS
FILING DATE	:	August 29, 2003
CONFIRMATION NO.	:	8842
EXAMINER	:	David J. Parsley
ART UNIT	:	3643
ATTORNEY DOCKET NO.	:	TOPP-P7.1-US
CUSTOMER NO.	:	021616

TO: Mail Stop APPEAL BRIEF – PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANT'S AMENDED BRIEF PURSUANT TO 37 C.F.R. § §1.192 and 41.37

Dear Sir:

This Amended Brief is being submitted in response to a Communication issued by the U.S. Patent and Trademark (PTO) titled Defective Appeal Brief dated June 5, 2007. (See enclosed Transmittal Letter for explanation.) Appellant appeals the rejections set forth in the Final Office Action dated March 7, 2006. A Notice of Appeal was filed along with the appropriate fee on July 10, 2006. Appellant's Brief was originally mailed on September 11, 2006 (September 10, 2006, being a Sunday.)

The PTO mailed a Notification of Non-Compliant Appeal Brief on September 26, 2006. In response to this communication, Applicant filed an Appellant's Appeal Brief Pursuant to 37 C.F.R. §§ 1.192 and 41.37 dated February 26, 2007.

I. Real Party in Interest

The real party in interest is Topp Construction Services, Inc., which is the assignee of record. (The assignment of this invention from the inventor to Topp Construction Services, Inc. was recorded at the PTO during the prosecution of priority U.S. Appln. No. 10/145,184 now U.S. Patent No. 6,612,067.)

II. Related Appeals and Interferences

There are no prior or other appeals, judicial proceedings, or interferences known to the Appellant regarding this application.

III. Status of Claims

Claims 32-52 are pending in this application and all are subject to final rejection. Claims 1-31 have been cancelled without prejudice.

Claims 32-52 are being appealed and are set forth in the Claims Appendix which is attached to this Brief.

IV. Status of Amendments

A Preliminary Amendment accompanied the initial filing of this application; the Preliminary Amendment cancelled claims 1-31 and added claims 32-51. A Reply and Amendment was filed on August 5, 2004, that amended certain claims and added claim 52. A Reply and Amendment to Final Office Action (including a Declaration Under 37 C.F.R. § 1.132 by Jeffrey S. Helmes) was filed on January 18, 2005, but was not entered initially by the Examiner.

Appellant filed a Request for Continuing Examination (RCE) on February 14, 2005, re-submitting the Reply and Amendment that was submitted after the Final Office Action as a submission required under 37 C.F.R. § 1.114. The Examiner then entered the Reply and Amendment. In response to the First Office Action after the filing of the RCE application, Appellant filed a Reply Pursuant to 37 C.F.R. §1.111 on October 20, 2005. In the Reply Pursuant to 37 C.F.R. § 1.111, claims 32, 33, 36, 42, 44 and 49 were amended.

The Examiner issued a (second) Final Office Action dated March 7, 2006, rejecting claims 32-34, 26 (sic) -40, 42-44, 49, and 51-52 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,716,676 to Imagawa; rejecting claims 35 and 50 as being unpatentable under 35 U.S.C. §103(a) over Imagawa in view of U.S. Patent No. 6,141,901 to Johnson et al.; rejecting claims 41 and 45-47 as being unpatentable under 35 U.S.C. §103(a) over Imagawa in view of U.S. Patent No. 5,965,185 to Bianco or U.S. Patent No. 6,227,002 to Bianco et al.; and rejecting claim 48 as being unpatentable under 35 U.S.C. §103(a) over Imagawa in view of U.S. Patent No. 3,814,315 to Dmysh.

After the Examiner issued the (second) Final Office Action, Appellant filed a Reply to Final Office Action (under 37 C.F.R. § 1.116) on June 14, 2006, which cancelled claim 50, amended claims 32, 34-36, 39, 40, 43, 44, 48, 49 and 51, and added claim 53. The Examiner issued an Advisory Action dated June 21, 2006, indicating that the Reply to Final Office Action would not be entered. Accordingly, claims 32-52 presented in the Reply Pursuant to 37 C.F.R. § 1.111 filed October 20, 2005, are the currently pending claims.

V. Summary of Claimed Subject Matter

There are currently three independent claims pending in this application, 32, 44 and 49.

A.) Concise Explanation of the Subject Matter Defined in Independent Claim 32

Appellant's claim 32 describes an apparatus for eradicating pests through the use of heated air. Referring to the original specification at page 9, lines 1-2, page 10, lines 2-6; page 14, lines 1-6 and 13-16; and to Figures 1A, 2B and 5A, Applicant's apparatus comprises a chamber 12 having a first end 14, a second end 16, a left wall 22, a right wall 24, a ceiling 13, a floor 50, a door 17 (or 18) that allows ingress to and egress from the interior of the chamber, a plenum (either 40 or 68) that delivers heated air from the heating means 52 to the chamber 12, a means for heating 52 air in the interior of the chamber, a means for circulating 71 air in the chamber 12, and a means for returning air (68 or 40) from the interior of the chamber 12 to the heating means 52.

Claim 32 has three means plus function clauses. Support for and explanation of the means plus function clauses are set forth below.

1.) MEANS FOR HEATING

The means for heating 52 is initially introduced on page 9, lines 16-20 (paragraph 0044 of Publication No. US2004/0035044 A1) and bridges over to page 10, lines 1-6, (paragraphs 0044 and 0045 in Publication No. US2004/0035044 A1). On page 10, lines 4-6, (paragraph 0045 in Publication No. US2004/0035044 A1) it is expressly disclosed that "[t]he heating means 52 may be a heater that utilizes electric, gas, oil, wood or other fossil-based fuel." The size (i.e., btu output) of the heater 52 depends on the volume of the chamber and the types of products to be heat-treated. Also, at page 13, lines 13-18, (paragraph 0058 of Publication No. US2004/0035044 A1), it is disclosed that the heating means 52 may be a forced air heater, a direct fired heater, or an indirect-fired heater. The means for heating 52 can be clearly seen in Figures 2B, 5A, 5B, 10A, and 10B as filed with the original application papers on August 29, 2003.

2. MEANS FOR CIRCULATING

Since air is the medium for transferring heat from the heating means (e.g., a direct-fired heater) to the desired volume, it is known in the art to circulate/move the heated air using one of the two following methods: The first method is to use the known physical property that heated air rises and letting physics take its course; the second known method is to "pull" air into a fan and "pushing" the air on the opposite side of the fan. When "forced air" is being used (in order to get enough heat into the desired volume, room, chamber, etc.) the primary means for circulating air in a forced air heating system, as is known in the art, is a fan.

Applicant's means for circulating, i.e., the fan assembly 71, is expressly disclosed in the specification at page 13, lines 19-20 bridging over to page 14, lines 1-6 (paragraphs 0059 and 0066 of Publication No. US2004/0035044 A1). The means for circulating/fan assembly 71 is clearly shown in Figures 10A and 10B.

3. MEANS FOR RETURNING AIR

The means for returning air from the interior volume of the chamber is expressly disclosed as either a ceiling plenum 68 or a floor plenum 40 depending on the type of product to be heat-treated and other factors (e.g., environmental, etc.) and is ultimately a choice of the end-user.

The basic operation of Applicant's apparatus for eradicating pests is disclosed in the original specification. Applicant's apparatus is designed to increase the efficiency of the heating process. The primary method of increasing the efficiency of the heating process disclosed by Applicant is through the use of a plenum that more evenly distributes the heated air within the chamber. (Applicant intended to take into account that heated air falls from the ceiling to the floor as it cools, and the air cools down the further it is moved away from the heater. In order to achieve the more even distribution of heated air within the chamber, Applicant uses a plenum in one embodiment to deliver the heated air. In another embodiment, Applicant discloses the use of a plenum to deliver the heated air and to return the air to the heating means.

It should be noted that one skilled in the art, after reading Applicant's disclosure, would also determine that a simple opening into the chamber with a plenum used only on the return passageway would also increase efficiency of the heating process, but it is believed that this

method is not as efficient as the embodiment in which the single plenum deliver the heated air and/or the embodiment in which two plenums are used – one for delivering the air and one for returning the air.

As explained in paragraphs 0059-0062, and Figure 10A, if the heated air is to be delivered to the chamber in order to heat the product, a floor plenum 40 is designed to distribute the heated air after being pushed by fan 71. In this embodiment, a ceiling plenum is efficient but not necessary – only a means of returning air back to the fan 71 and heating means 52 is required.

Similarly, in the embodiment of Figure 10B, the air direction is reversed and heated air is delivered from above the product by a ceiling plenum. In this example the ceiling plenum 68 delivers the heated air that is pushed from fan 71 to the chamber above the product. In this embodiment, a floor plenum 40 will increase that efficiency but is not necessary to return the air to the heating means to be re-heated.

As one skilled in the art can readily understand, only one plenum is actually required to distribute the air evenly within the chamber. The other plenum can return the air to the heater 52 but is not required. Depending on the type of product to be treated, and/or on the use defined by the end-user, the air can be moved in a clockwise motion as viewed from the side in Figure 10A or in a counter-clockwise direction as viewed from the side in Figure 10B. In Figure 10A the means for circulating 71 the air draws air from the chamber via a ceiling plenum 68 as shown, or via an ordinary duct (not shown) or via a simple opening in the chamber (not shown). The ceiling plenum 68 shown in Figure 10A is the most complicated method of connecting the interior of the chamber to the circulating means and heating means but is the most efficient for

ensuring that the heat evenly heated within the chamber, thereby ensuring that the product at one end of the chamber is relatively close in temperature to the heated product at any part of the chamber. The means for circulating 71 pulls or draws the air for returning air from the interior volume of the chamber.

The heating means 52 is in communication with the floor plenum 40 for evenly distributing the heated air throughout the interior chamber. After the heated air passes through the product, thereby giving up most of its heat by raising the temperature of the product, it returns to the means for circulating 71.

Similarly, as shown in Figure 10B, in which the air moves in the opposite direction. In this embodiment, similar to the embodiment illustrated in Figure 10A, the air delivery method is the most important feature of evenly distributing the heated air within the interior chamber. In this embodiment, the ceiling plenum delivers the heated air to the interior of the chamber. The floor plenum will further ensure that the heated air is evenly distributed but is not as important as the ceiling plenum in the embodiment. Accordingly, a simple duct (not shown) or just an opening into the interior of the chamber is sufficient to complete the closed system.

As illustrated in Figures 10A and 10B, and described at page 10, lines 7-9, page 12, lines 17-20 and page 13, lines 1-10, Appellant claims at least one plenum (floor plenum 40 or ceiling plenum 68) for delivering air heated by the heating means 52 to the interior volume of the chamber 12. The plenum (40 or 68) communicates with a means for circulating 71 the air for improving the distribution of the heated air in order to heat the interior of the chamber more evenly, and a means for returning (ceiling plenum 68 or floor plenum 40) the air from the interior

of the chamber to the heating means 52 in order to heat-treat any products placed within the chamber to a temperature that is lethal to pests.

B.) <u>Concise Explanation of Subject Matter Defined in Independent Claim 44</u>

Appellant's claim 44 claims an apparatus for eradicating pests using heated air.

Referring to the original specification at page 9, lines 1-2, page 10, lines 2-6, page 14, lines 1-6 and 13-16 and to Figures 1A, 2B and 5A, Applicant's apparatus comprises a chamber 12, a means for heating 52 air, and a plenum (e.g., 40) that either delivers heated air from the heating means 52 to the chamber 12 or returns air from the interior of the chamber 12 to the heating means 52 for assisting in more even air distribution within the chamber 12.

With respect to claim 44, the only means plus function clause is "a means for heating air." The means for heating air is substantially identical to the means for heating air recited in claim 32. Therefore, the description of the means for heating air is set forth above also applies to claim 44.

The means for heating 52 is initially introduced on page 9, lines 16-20 (paragraph 0044 of Publication No. US2004/0035044 A1) and bridges over to page 10, lines 1-6, (paragraphs 0044 and 0045 in Publication No. US2004/0035044 A1). On page 10, lines 4-6, (paragraph 0045 in Publication No. US2004/0035044 A1) it is expressly disclosed that "[t]he heating means 52 may be a heater that utilizes electric, gas, oil, wood or other fossil-based fuel."

Appellant's invention described in claim 44 does not require both a heated-air supply means and a means for returning air to the heater 52. In particular, it is well-known in the art to draw air from the outside, heat the drawn-in air and direct the heated air into the desired volume,

which in this case is a chamber.

As described at page 10, lines 7-9, and shown in Figures 5A, 10A, and 10B, a single plenum (in this case a floor plenum 40) is disclosed which can either supply the hot air to the chamber or return the hot air to the heater 52. Since the chamber is not necessarily air-tight, if the plenum is used to deliver heated air to the chamber, no actual return is needed and the heater draws air from the outside. Alternatively, if a plenum is used to return the air to the heater 52, the hot air can just be blown into the chamber from a direct connection from the heating means 52 through an opening in a wall of the chamber 12.

C) **Concise Explanation of Subject Matter Defined in Independent Claim 49**

Appellant's independent claim 49 claims an apparatus for eradicating pests using heated air. Referring to the original specification at page 9, lines 1-2, page 10, lines 2-6, page 14, lines 1-6 and 13-16 and to Figures 1A, 2B and 5A, Applicant's apparatus comprises a chamber 12, a heating means 52, a means for circulating 71 air, and a ceiling plenum 68 connected to the inlet of the circulating means 71 that draws air from the chamber 12 to be delivered to the heating means 52 for heating the air in the interior of the chamber.

With respect to claim 49, the only means plus function clause is "a means for circulating air" which is identical to the means for circulating air 71 recited in claim 32. Therefore, the description of the means for circulating 71 set forth above also applies to claim 49.

Applicant's means for circulating, i.e., the fan assembly 71, is expressly disclosed in the specification at page 13, lines 19-20 bridging over to page 14, lines 1-6 (paragraphs 0059 and

0066 of Publication No. US2004/0035044 A1). The means for circulating/fan assembly 71 is clearly shown in Figures 10A and 10B.

Claim 49 recites only a ceiling plenum 68 for returning air to the heating means 52 from the chamber. It is known in the art to connect the outlet of the heating means 52 to direct hot air into the chamber 12 without a supply plenum.

VI. Grounds of Rejection to be Reviewed on Appeal

There are five issues presented for review in this appeal. Specifically, these issues are:

A) Whether claims 32-34, 36-40, 42-44, 49, 51, and 52 are unpatentable under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,716,676 to Imagawa;

B) Whether claims 32-34, 36-40, 42-44, 49, 51, and 52, are unpatentable as being obvious in view of Imagawa;

C) Whether the combination of Imagawa in view of U.S. Patent No. 6,141,901 to Johnson et al. is proper to form the basis of a rejection under 35 U.S.C. §103(a) and, in particular, to reject claims 35 and 50;

D) Whether to combination of Imagawa in view of U.S. Patent No. 5,965,185 to Bianco or U.S. Patent No. 6,227,002 to Bianco et al. is proper to form the basis of a rejection under 35 U.S.C. §103(a) and, in particular, to reject claims 41 and 45-47; and

E) Whether the combination of Imagawa in view of U.S. Patent No. 3,814,315 to Dmysh is proper to form the basis of a rejection under 35 U.S.C. §103(a) and, in particular, to reject claim 48.

VII. Argument

A.) Imagawa cannot anticipate Appellant's invention

A rejection under 35 U.S.C. §102(b) requires that each and every element of the claimed invention be taught by the cited reference. Since a patent must describe and enable an invention to one skilled in the art, an anticipatory patent by definition must place the claimed invention into the public domain.

1. Steam/boiler systems cannot anticipate hot air/furnace systems

Imagawa discloses a system for destroying insects using steam. Every embodiment of Imagawa's insect killing system disclosed in U.S. Pat. No. 4,716,676 utilizes a "steam generator 12," and steam as the medium to transfer heat from the steam generator to Imagawa's chamber.

In contrast to Imagawa, Appellant's independent claims 32 and 44 recite the limitation "a means for heating air" while Appellant's independent claim 49 recites the limitation "a heater having the capacity to heat the air."

The structural differences between a steam-generator (usually referred to as a boiler in the United States) and a furnace for heating air are significant. Moreover, the means to move steam verses the means to move hot air to the space that is desired to be heated are also different.

One skilled in the art would readily recognize the differences between a technology that deals with heating air and a technology that deals with producing steam. In the case of basic heating systems, one skilled in the art does not even require a college degree. (See page 6, Table 1-1, Type of Work or Education and/or Training Required, *Audel™ HVAC Fundamentals*

Volume I – Heating Systems, Furnaces, and Boilers, 4th Edition, James E. Brumbaugh, ©2004 by Wiley Publishing, Inc., Indianapolis, IN.

> Many different methods have been devised for heating buildings. Each has its own characteristics, and most methods have at least one objectionable aspect (e.g., high cost of fuel, expensive equipment, or inefficient heating characteristics)... The term *heat-conveying medium* means that the substance that carries the heat from its point of origin to the area being heated. There are basically four mediums for conveying heat. These four mediums are:
>
> 1. Air
> 2. Water
> 3. Steam
> 4. Electricity

Page 2, lines 13 - 17 and 24-31, *Audel™ HVAC Fundamentals Volume I – Heating Systems, Furnaces, and Boilers*, 4th Edition, James E. Brumbaugh, ©2004 by Wiley Publishing, Inc., Indianapolis, IN.

After identifying the four basic heat-conveying mediums, *Audel*™ then defines the mediums.

Air

Air is a gas consisting of a mechanical mixture of 23.2% oxygen (by weight), 75.5% nitrogen, 1.3% argon with small amounts of other gases. It functions as the heat-conveying medium for warm-air heating systems... (See Audel at pg. 16.)

Steam

Those who design, install, or have charge of steam heating plants certainly should have some knowledge of steam and its formation and behavior under various conditions.

Steam is a colorless, expansive, and invisible gas resulting from the vaporization of water. The white cloud associated with steam is a fog of minute liquid particles formed by condensation. This white cloud is caused by the exposure of the steam to a temperature lower than that corresponding to its pressure. ...

The various changes that take place in the making of steam are known as vaporization...

Another important factor to consider when dealing with steam is the boiling point of liquids. ...

> One's knowledge of the fundamentals of steam heating should also include an understanding of the role that condensation plays. By definition, *condensation* is the change of a substance from the gaseous to the liquid (or condensate) form. ...
>
> The condensation of steam can cause certain problems for steam heating systems unless they are designed to allow for it...
>
> (See *Audel* at pgs. 18-21.)

A system utilizing warm air as a medium for carrying the heat does not have to take into consideration the effects of vaporization, boiling points of liquids, condensation and other factors commonly associated with a heating system that utilizes steam. In fact, a heating system that produces warm air is completely different in structure and operation than a heating system that produces steam. This not only includes the method of producing the medium (heater for warm air vs. boiler for steam) but how that medium is delivered to the desired location.

Applicant respectfully submits that:

A) Imagawa discloses the use of steam to kill pests. In contrast, Applicant's independent claims 32, 44 and 49 all have the limitation that the Applicant's apparatus destroys pests through the use of heated air.

B) Imagawa requires a boiler to produce steam. A boiler is designed to heat water to at least the boiling point of water (212° F) in order to produce steam. Applicant requires a heater that heats air and Applicant does not claim a boiler. (Applicant's

heater does not need to produce heat at 212° F, nor is it designed to boil water.)

C) Imagawa floods its outer chamber with steam and then redirects the steam through a plurality of hoods 21 and blowers 10, 11. Applicant utilizes a plenum to control the introduction of the heated air into the chamber. As supported by the Helmes Declaration and the *Audel* publication (See Chapter 6), a plenum is used to direct heated air, not steam.

The Applicant's two basic premises: 1) a heating system that produces steam is so different structurally and operationally from a heating system that produces warm air that any steam system cannot anticipate an invention based on heated air; and 2) a plenum is designed to channel air not steam; are well-known in the art. The Applicant has supported his arguments with a well-known and well-respected engineering texts, a Declaration Under 37 CFR §1.132, and an HVAC publication from *Audel*, that expressly support the Applicant's position. The Examiner's only source is a Webster's dictionary definition and he did not even provide the bibloiographic information for the dictionary. (Applicant presumes that the "Webster's" dictionary – of which there are probably scores of – is not an engineering reference.) In addition, Applicant's evidence completely refutes the statements made by the Examiner.

"A *warm-air heating system* is one in which the air is heated in a furnace and circulated through the rest of the structure either by gravity or motor-driven centrifugal fans. If the former is the case, then the system is commonly referred to as a *gravity warm-air heating system*. Any system in which air circulation depends *primarily* on mechanical means for its motive force is

called a *forced warm-air heating system*." (See page 125, *Audel™ HVAC Fundamentals Volume I – Heating Systems, Furnaces, and Boilers*, 4th Edition, James E. Brumbaugh, ©2004 by Wiley Publishing, Inc., Indianapolis, IN, emphasis in the original).

Audel continues by stating:

> The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) defines a furnace as a complete heating unit for transferring heat from fuel being burned to the air supplied to a heating system." The *Standard Handbook for Mechanical Engineers* (Baumeister and Marks, seventh edition) provides a definition that differs only slightly from the one offered by ASHRAE: "a self-enclosed, fuel-burning unit for heating air by transfer of combustion through metal directly to the air." Contained within these closely similar definitions are the two basic operating principles of a furnace: (1) Some sort of fuel is used to produce combustion, and (2) the heat resulting from this combustion is transferred to the air within the structure. Note that *air* – not steam, water, or some other fluid – is used as the heat conveying medium. This feature distinguishes warm-air heating systems from the other types; see Chapter 6, "Warm-Air Heating Systems."

(Page 273, *Audel™ HVAC Fundamentals Volume I – Heating Systems, Furnaces, and Boilers*, 4th Edition, James E. Brumbaugh, ©2004 by Wiley Publishing, Inc., Indianapolis, IN.)

As set forth on page 10, lines 2-3 of Appellant's specification, "A heating means 52 is the device to heat the air inside the chamber and provide the necessary heat to treat the wood products stored within the chamber."

Appellant's specification, figures (including Figures 2B, 5A, 5B, 10A and 10B), and claims expressly describe a warm-air heating system. One skilled in the art would immediately discern that Applicant is utilizing a "furnace" as defined by either ASHRAE or the *Standard Handbook for Mechanical Engineers* and air as the medium to transfer heat from the furnace to the chamber. Appellant's heating means 52 heats the air directly as is understood by those in the industry, and when interpreting the common HVAC terms means for heating air, hot-air heater, direct-fired heater and furnace. Appellant's system does not heat water or any other liquid, nor does it produce steam as is disclosed in Imagawa.

One skilled in the art would readily recognize the structural differences between a system that requires a steam generator to produce steam and an apparatus that uses a furnace to produce hot air. In addition, one skilled in the art would appreciate the significant differences between a system that utilizes steam as the medium to transfer heat and a system that uses air to transfer heat. Moreover, one skilled in the art would understand the structures necessary to deliver steam from a boiler to the space needed to be heated and the structures necessary to deliver the hot air from a furnace to the space needed to be heated.

The *Audel* series is an introductory series to HVAC systems. The subject matter covered in *Audel* is comparable to any introductory series of text books on HVAC systems. Accordingly, a person of ordinary skill in the art of Appellant's invention would be very familiar with the principles set forth in *Audel*. (The relevant pages of *Audel* cited herein are reproduced in EVIDENCE APPENDIX B attached hereto.)

Audel™ expressly defines the four heat-conveying mediums, including the two mediums relevant to the subject matter at hand.

> **Air**
>
> Air is a gas consisting of a mechanical mixture of 23.2% oxygen (by weight), 75.5% nitrogen, 1.3% argon with small amounts of other gases. It functions as the heat-conveying medium for warm-air heating systems... (*Audel*, pg. 16.)
>
> **Steam**
>
> Those who design, install, or have charge of steam heating plants certainly should have some knowledge of steam and its formation and behavior under various conditions.
>
> Steam is a colorless, expansive, and invisible gas resulting from the vaporization of water. The white cloud associated with steam is a fog of minute liquid particles formed by condensation.

> This white cloud is caused by the exposure of the steam to a temperature lower than that corresponding to its pressure. ...
>
> The various changes that take place in the making of steam are known as vaporization...
>
> Another important factor to consider when dealing with steam is the boiling point of liquids. ...
>
> One's knowledge of the fundamentals of steam heating should also include an understanding of the role that condensation plays. By definition, *condensation* is the change of a substance from the gaseous to the liquid (or condensate) form. ...
>
> The condensation of steam can cause certain problems for steam heating systems unless they are designed to allow for it... (*Audel*, pgs. 18-21.)

It should be noted that the application that issued into U.S. Patent No. 4,716,676 (Imagawa) is a continuation-in-part from U.S. Serial No. 647,030 filed September 4, 1984, which in turn claims priority to Japanese Application No. 58-17102. It is somewhat unfortunate that the Imagawa patent was not originally written in English. Appellant believes that the term "steam generator" may be a literal translation from Japanese and, although technically accurate, as indicated in *Audel*, in the United States an apparatus that heats water for producing steam is commonly referred to as a "boiler."

"Steam is a very effective heating medium. Until recently, this property of steam has resulted in its being the most commonly used method of heating residential, commercial, and industrial buildings. Over the last 40 years or so, steam heating has been largely replaced in residences and small buildings by other heating systems that have often proven to be less expensive to install and operate or that operate at similar or greater levels of efficiency in small structures." *Audel*, pg. 185.

Appellant's claimed invention recites "a means for heating," as expressed in *Audel* and after a reading of Appellant's specification, it would be clear to one skilled in the art that Appellant is referring to a "furnace" or similar direct-fired heater and not a steam-generator or boiler. (See *inter alia* pgs. 9-10, and Figures 5A, 5B, 10A and 10B from Appellant's specification). In fact, Figures 10A and 10B, show a schematic representation of a forced-air heater illustrating the direction of air flow in each embodiment and is recited in Appellant's claim 32.

Imagawa discloses a "steam generator" that heats water to its boiling point to produce steam. A "steam generator" does not heat air as disclosed or claimed by Appellant, or as commonly understood by a person of average skill in the HVAC industry. As such, Imagawa does not teach "each and every element" of the claimed invention. Therefore, Imagawa cannot anticipate Applicant's independent claims 32, 44 and 49 or any claim that depends from them.

2. Systems Utilizing Steam as the Heat-Conveying Medium Cannot Have Plenums

Imagawa, being a system utilizing steam, does not have a use for a plenum and does not

disclose a plenum. Appellant's independent claims 32, 44 and 49 all recite the limitation of a plenum for distributing the heated air within the chamber.

In addition to a "steam generator," Imagawa discloses a circulation chamber (A) that directs steam through a series of vertical self-contained units that enclose harvest boxes filled with fruit. The self-contained units are called "insect killing cells" (B). The circulation chamber utilizes a plurality of blowers 10 that move the steam in a horizontal direction. Each insect killing cell is a separate unit which includes a hood having a differential blower mounted on the hood to draw steam from the floor, through the fruit boxes and out the top of the hood (i.e., moves steam in a vertical direction). A heating device 13 and a cooling device 14 communicate with the circulation chamber (A) via a pair of discharge ports 15.

The Examiner has repeatedly stated in several Office Actions that Imagawa discloses both a ceiling plenum and a floor plenum. The Examiner makes numerous references to Figures 2, 6 and 7 of Imagawa in an attempt to support his position that Imagawa discloses a ceiling plenum. Unfortunately, Appellant is not sure what the Examiner is referring to since the Examiner refuses to use reference numerals – even after repeated requests from Appellant to do so.

Imagawa discloses a chamber (A) with a first end, a second end, a left wall, a right wall, a ceiling and a floor. However, there is no sub-ceiling shown or discussed in Imagawa. The Examiner states that Figure 2 shows a "sub-ceiling." The only element to which the Appellant can discern that somewhat appears to be a sub-ceiling in Figure 2, is actually a beam 27 that is supported by its own support structure within chamber (A), and can be more clearly seen in Figures 1, 3 and 4. Beams 27, illustrated in Imagawa, are used in conjunction with a pulley or

wench 26 to form a "winding means." (See column 3, lines 20-25 of Imagawa.) The winding means is designed to "move vertically" hoods 21. The hoods 21 cap each "insect killing cell" (B) of Imagawa. Appellant respectfully submits that the beams 27 do not form a sub-ceiling and Imagawa does not disclose a plenum.

Further, Imagawa does not disclose a floor plenum. Imagawa's chamber keeps the steam moving in a counter clockwise motion as illustrated in Figure 1. Blowers, 10a, 10b, 10c, and 11a, 11b, 11c, keep the steam moving horizontally across the fruit within the Imagawa circulation chamber A. In addition, Imagawa employs hoods 21, differential fans 22, mounted on top of the hoods, and a cover member 23 for covering th outer peripheral surfaces of the harvest boxes to draw steam from the bottom of the chamber, through rollers 16, 17, through chamber harvest boxes and into the upper portions of the chamber. (See Column 3, lines 20 - 38.)

Appellant has requested several times for the Examiner to use reference numerals to identify the alleged ceiling plenum and/or a floor plenum the Examiner claims is disclosed in Imagawa, but the Examiner has repeatedly failed to do so. Accordingly, Appellant is forced to made an "educated guess" to ascertain the structures that the Examiner states are plenums.

In addition to not disclosing a heater to heat air, Imagawa does not disclose, teach or suggest a plenum. Appellant's independent claims 32, 44 and 49 all recite the limitation of a plenum for distributing the heated air within the chamber. Imagawa, being a system utilizing steam, does not have a use for a plenum.

In one embodiment, the Appellant discloses a ceiling/subceiling assembly (referred to as a ceiling plenum 68) to deliver the heated air to the interior of the chamber, and in the same

embodiment, the Appellant discloses a floor/subfloor assembly (referred to as a floor plenum 40) to return the air to the heating means. As set forth at page 5, lines 12-15 of Appellant's specification, "The interior ceiling and the interior sub-ceiling, and the floor/subfloor are uniquely designed to control the flow of air within the chamber. The means for re-circulating the heated air within said interior of said chamber communicates with the heating means. The floor air plenum runs the entire length of the interior floor, and consists of perforated floor sections that form the primary floor."

To further support its position, Appellant submitted a Declaration of Jeffrey S. Helmes Under 37 CFR § 1.132 (hereinafter the "Declaration") which accompanied the first Reply and Amendment to Final Office Action dated January 13, 2005, and was re-submitted with the Request for Continuing Examination on February 14, 2005, as a submission required under 37 C.F.R. §1.114. Appellant has attached Mr. Helmes' Declaration herewith and has labeled it Evidence Appendix A.

It is well-known that HVAC systems are taught in Mechanical Engineering degree programs. Mr. Helmes has a Bachelors of Science Degree in Mechanical Engineering from Drexel University and, as of January 2005, had over twelve years experience as a Mechanical Engineer at the time the Declaration was signed (plus eight years concurrently working part-time with the Appellant). He is currently employed as a Senior Project Engineer at Maguire Products, Inc. in Aston, Pennsylvania.

As stated in his Declaration, Mr. Helmes was unable to discern what the Examiner identifies as a sub-ceiling forming a plenum in Imagawa. (See the Declaration at paragraph E)

Mr. Helmes continues by stating, a plenum cannot be used to carry steam, and Imagawa does not disclose either a ceiling plenum or a floor plenum as used in the HVAC industry.

An important advantage of Applicant's invention is that by directly heating air and moving that air into the chamber, the products being treated with heat are not saturated in water at the conclusion of the heat-treatment. Imagawa floods its chamber with steam, thereby ensuring that all objects within the chamber will be coated with water when the interior of the chamber returns to "room temperature."

Imagawa floods the entire interior volume of the chamber with steam and uses a plurality of pyramidally-shaped hoods that direct the steam over the fruit. This structural arrangement is dissimilar to any "normal" ventilation system known and cannot define a plenum as is commonly known in the HVAC industry. In a typical steam heating system, the heat is transferred to the structure through the use of pipes and radiators (steam does not actually come in contact with the items or volume which are supposed to be heated). An important drawback of flooding the interior chamber with steam as taught by Imagawa is that the water vapor begins to immediately condense on items that are less than 212° F, and forms water. Metals will oxidize (e.g., iron will rust) when exposed to water, and porous items (paper, wood, etc.) will absorb the water which will promote the growth of mold.

In paragraph E of the Declaration, Mr. Helmes sets forth the general definition of a "plenum" as an enclosed portion of a ventilation system that delivers or receives air from a blower for distribution in a ventilation system. Mr. Helmes cited two industry sources to support

his definition of a "plenum," namely the *Uniform Mechanical Code 2000* and the *1998 International Mechanical Code*. (See the Declaration at paragraph E.)

Books on Mechanical Engineering, HVAC and related topics (e.g., the Uniform Mechanical Code) identify the differences between air and steam. As set forth previously, *Audel* presents very specific definitions and classifies heating systems according tot he type of medium used to transfer heat (air, water, steam and electricity). In the Office Action of April 14, 2005, the Examiner provided Webster's dictionary definition of plenum as "an air-filled space in a structure."

Mr. Helmes states that "there are few similarities in a system that delivers steam and one that delivers heated air." (*See* paragraph G of the Declaration.) Mr. Helmes concludes, "to the best of my knowledge, no HVAC plenums are designed to deliver steam."

The Declaration was submitted to present objective evidence of patentability based on an analysis of the teachings of Imagawa. The Examiner dismissed the Declaration stating that the "Declaration was merely opinion." (See Examiner's Office Action dated April 14, 2005.) However, Mr. Helmes statements, including the aforementioned quote that there are few similarities between a hot air heating system and a steam heating system, are clearly supported by *Audel*. In addition, Mr. Helmes cited the *Uniform Mechanical Code 2000*, sections 601 and 602, and the *1998 International Mechanical Code*, sections 602 and 1304 for his definition of a "plenum." The Examiner's dismissal of Mr. Jeffery Helmes' Declaration as "merely opinion" with no basis or fact to back his opinion is inappropriate. For this reason alone, the Appeal Board should reverse the Examiner's decision.

In paragraph 5 of the Office Action dated April 14, 2005, the Examiner states, "steam, like air is a gas and it is the Examiner's position that the device of Imagawa discloses a plenum no matter what type of gas is placed inside the plenum." The Examiner never provides a citation to support his "position." In an industry that is very specific in its use of the terms "steam" and "air," the Examiner has failed to consider the differences between steam and air and the differences in the equipment that produces steam versus equipment that produces heated air. Clearly, based on the definitions in *Audel*, "steam" is not the same as "air" in the HVAC industry. Steam is water vapor (i.e., water heated over 212°F) and by definition has a high humidity; heated air is a mechanical mixture of primarily nitrogen and oxygen, and usually has a relatively low humidity. *Audel* pages 18-21.

Plenums are not designed to take the high humidity or the higher temperature associated with steam. Further, Appellant contends that the *Uniform Mechanical Code 2000* definition of a "plenum" for use in a "ventilation" system implies that the medium that is channeled within the plenum is a breathable gas (i.e., air). Appellant respectfully submits that a chamber flooded with steam (which by definition must exceed 212°F) is not fit for "ventilation."

One skilled in the art would be familiar with the formation of steam and its behavior at specific temperatures and pressures. The basic operating principles of steam heating are well-known. "A boiler is used to heat water until it turns to steam. When the steam releases its heat, it condenses and returns to the boiler in the form of water for reheating." (See *Audel* at pg. 185.)

Imagawa does not disclose either a ceiling plenum or a floor plenum as claimed by Appellant. In order to disclose or teach the use of a plenum to deliver heated air, the heating

system must be a hot air system – not a steam-producing system. Accordingly, Imagawa cannot anticipate Appellant's invention as recited in claims 32, 44 and 49, or any claim that depends therefrom.

As illustrated in Imagawa's Figure 1 and 2, the steam generator 12 sprays steam directly into the chamber. There is no description in Imagawa or illustration showing that the steam (or water after the steam cools and condenses) is re-circulated back into the steam-generator to be reheated. Imagawa does not disclose what happens to the steam after the produce has been treated. Apparently, the steam condenses and water trickles to the floor of the chamber. Regardless, Appellant expressly recites in claims 32 and 49 that the air from the heater is returned to the heater and re-circulated within the chamber.

Appellant's claims 32, 44 and 49 all recite use of at least one plenum. Applicant claims a second plenum in claim 33 (one plenum to deliver heated air and a second plenum to return air to the heating means). As set forth in *Audel* and the earlier-filed Declaration signed by Jeffrey Helmes, a heating system that uses steam as a medium for delivering heat does not utilize a plenum. Not only does Imagawa fail to disclose, teach or suggest one plenum, it fails to disclose, teach or suggest two plenums.

Appellant submits that:

A) Imagawa discloses the use of steam to kill pests. In contrast, Applicant's independent claims 32, 44 and 49 include the limitation that the Appellant's apparatus destroys pests through the use of heated air.

B) Imagawa requires a boiler to produce steam. A boiler is designed to heat water to at least the boiling point of water (212° F) in order to produce steam. Imagawa does not disclose a hot air heater or furnace. In contrast, Appellant utilizes a heater for heating air as claimed in claims 32, 44 and 49. (Appellant's heater does not need to produce heat at 212° F, nor is it designed to heat air to such a high temperature, and is not designed to boil water.)

C) Imagawa floods its outer chamber with steam and then redirects the steam through a plurality of hoods 21 and blowers 10, 11. In contrast, Appellant utilizes a plenum to control the introduction of heated air into the chamber.

D) Imagawa does not disclose a means for returning steam (or the water that has condensed after cooling) to the steam-generator to reheat the steam/water for re-introducing the steam into the chamber. In contrast, Appellant claims a means for returning the air to the hot air heater to be continuously re-heated and returned to the chamber.

In view of the above structural differences, Appellant respectfully submits that Imagawa does not disclose "each and every element" as required by 35 U.S.C. § 102 and respectfully requests that all rejections based on §102 be reversed.

B. Imagawa by itself cannot make obvious Appellant's claimed invention

A *prima facie* case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art. *In re Rinehart*, 531 F.2d 1048, 189 U.S.P.Q. 143, 147 (C.C.P.A.).

As discussed above in *Audel*, a typical heating system that relies on a "steam generator" or boiler to produce steam as the heat-conveying medium for heating an object or volume is

dissimilar to a heating system that produces warm air and uses air as the heat-conveying medium for heating an object or volume.

Audel repeatedly identifies, discloses and explains the differences between a heating system that heats air directly and one that uses a boiler to heat water until it produces steam. One skilled in the art would be very familiar with the subject matter explained in *Audel*, and would readily know the differences between a "hot air" heating system and a "steam" heating system.

Heating systems are generally classified by the substance that carries the heat from its point of origin to the area being heated. There are basically four mediums for conveying heat. These four mediums are:

1. Air
2. Water
3. Steam
4. Electricity

Audel™ HVAC Fundamentals Volume I – Heating Systems, Furnaces, and Boilers, 4th Edition, James E. Brumbaugh, ©2004 by Wiley Publishing, Inc., Indianapolis, IN, pgs. 2-3.

Appellant's original specification expressly discloses that the interior of the chamber is heated by recirculating the air. For example, see paragraphs 11, 13, 55, 57, et. seq. from Publication No. US 2004/0075044 A1. Appellant submits that one skilled in the art, after just a cursory review of Applicant's drawings (including Figures 2B, 5A, 5B, 10A and 10B), would immediately know and understand that Appellant is utilizing a "forced-air heater" or "furnace" as

defined by either ASHRAE or the *Standard Handbook for Mechanical Engineers* and not a boiler. Appellant's independent claims 32, 44 and 49 all recite a means for heating air.

Appellant's heating means heats the air directly as is understood by those in the industry. Applicant's claimed system does not heat water, steam or any other liquid as is disclosed in Imagawa and Applicant's claimed invention does not require a boiler or "steam generator."

As indicated in *Audel*, there are four primary types of heating systems, steam and hot-air systems are two of these primary types. One skilled in the art of steam systems is not necessarily skilled in the art of hot-air heating systems and vice versa. As a real-world example of this, heating contractors sometimes indicate that they only handle one form of heating or the other.

Every embodiment disclosed in Imagawa requires a steam generator. Every embodiment claimed by Appellant cites a means for heating air. (See independent claims 32, 44 and 49.) A steam-generator is structurally different than a heater that heats air, and Imagawa does not teach or suggest the subject matter claimed by Appellant. Therefore, one skilled in the art, after reading and understanding the teachings of Imagawa, would not be led to a warm-air heating system as claimed by the Appellant.

Just as important as the system for creating the heat-transferring medium is the method of delivery and moving warm-air versus the method of delivery and moving steam. A "plenum" is used to channel heated air in a system that produces warm air. Appellant submits that, based on *Audel* the Helmes Declaration, and the *Uniform Mechanical Code 2000* definition, Imagawa does not disclose or suggest a plenum as is commonly defined in the art.

Further, Imagawa simply floods the interior chamber with steam and uses pyramidally-shaped hoods to generally direct the steam towards the fruit. The pyramidally-shaped hoods are not plenums and there is no disclosure or suggestion of a plenum in Imagawa. Imagawa states throughout the specification that his invention produces steam to kill insects. Imagawa does not disclose a ventilation system that directly heats air. No where does Imagawa disclose or suggest that it utilizes hot air to kill pests/insects, and there are no plenums or "air-filled" spaces in Imagawa as is known to one skilled in the art. In fact, during operation there can be no air-filled spaces in Imagawa – only spaces filled with steam.

Appellant's invention is primarily intended to treat wood and wood products including wood packaging and pallets. (See paragraph 48 from Publication No. US 2004/0035044 A1.) These wood products are dried (preferably in a kiln) before being assembled. Otherwise, after assembly, the individual wood pieces would dry at different rates increasing the probability that the wood pieces would separate after being assembled, for example, into a pallet. Also, Appellant discloses that its claimed invention can treat machinery, food products, and other dry staples. (See paragraph 47 from Publication No. US 2004/0035044 A1.) By subjecting these products to steam as taught by Imagawa would have a negative effect on the products (machinery will rust, food products and wood packaging would become moldy or would otherwise be destroyed).

Pursuant to MPEP §2143.01, the proposed modification must suggest the desirability of the claimed invention, the proposed modification cannot render the prior art unsatisfactory for its intended purpose, and the proposed modification cannot change the principle of operation of a

reference. The Examiner's use of Imagawa as the basis for an obviousness rejection violates all three of these principles.

Imagawa is specifically designed to steam-treat fruit. The fruit is not harmed by being subjected to the steam, nor are they degraded when the fruit returns to room temperature and the steam converts to water vapor. Treating wood products, machinery, food products and similar staples in a system taught by Imagawa, would be futile since the steam would destroy or adversely effect the products being heat-treated. Therefore, Imagawa not only fails to teach or suggest Appellant's structural elements, it fails to suggest the desirability and there is no expectation of success of using Imagawa's invention. In fact, Imagawa's treatment would be so detrimental to many of the items being heat-treated by Appellant (e.g., macaroni and other food products, any items having iron, etc.) as to make the treated items unusable.

A system utilizing warm or hot air as a medium for carrying the heat does not have to take into consideration the effects of vaporization, boiling points of liquids, condensation and other factors commonly associated with a heating system that utilizes steam. In fact, a heating system that produces warm air is completely different in structure and operation than a heating system that produces steam. This not only includes the method of producing the medium (furnace for warm air vs. boiler for steam) but how that medium is delivered to the desired location. The basic operating principles of Imagawa are being modified by the Examiner to the point that it is no longer suitable for its intended purpose in violation of MPEP §2143 in order to form the basis of an obviousness rejection; accordingly, the Examiner's rejection must be overturned.

Under MPEP 2143.03 all claim limitations must be taught or suggested by the prior art to establish a case of prima facie obviousness. MPEP 2143.03 further states that if an independent claim is nonobvious under 35 U.S.C. §103, then any claim depending therefrom is nonobvious.

Imagawa does not disclose or suggest a "hot-air heater," does not disclose or suggest a system that utilizes a plenum for directing the heat-carrying medium, and does not disclose or suggest a system that produces "hot air" to kill insects. Accordingly, Imagawa, by itself, cannot make obvious Appellant's claims 32-34, 36-40, 42-44, 49, 51, and 52. In fact, using the treatment as disclosed and taught my Imagawa would make Appellant's claimed invention unsatisfactory for its intended purpose. Therefore, the Appeals Board must reverse the Examiner's decision of using Imagawa as the basis for any rejection.

C. The Examiner's rejection of claims 35 and 50 under 35 U.S.C. § 103(a) over Imagawa in view of U.S. Patent No. 6,141,901 to Johnson et al. is based on an improper combination

Imagawa discloses an apparatus for destroying insects using steam. Every embodiment of Imagawa's insect killing system disclosed in U.S. Pat. No. 4,716,676 utilizes a "steam generator 12."

U.S. Pat. No. 6,141,901 to Johnson et al. discloses a method of controlling pests by heating outside air and delivering this heated air to an enclosed treatment zone. The treatment zone is either an entire building that has been sealed off, or a room or rooms of a building that have been isolated from the rest of the building. The heating system of Johnson draws in outside

air, heats the air to a lethal temperature and directs the air into the treatment zone in order to maintain a lethal temperature for at least eleven hours. The treatment is commenced after determining air penetration parameters for the treatment zone. The temperature in the treatment zone is elevated at a rate of between 5° F and 10° F per hour until the air temperature reaches the lethal level.

As quoted previously from *Audel*, steam heating systems and air heating systems are two of the four primary types of heating systems (along with hot water and electricity). Each of the four systems utilizes their own apparatus for generating heat and for delivering the heat to the desired space. Imagawa's steam system has nothing in common with Johnson's warm air system.

There is no suggestion in either Imagawa or Johnson et al. for modifying or adopting an apparatus that produces steam for use with a method or apparatus that produces warm air. Accordingly, there is no motivation to combine Imagawa with Johnson, and the Examiner's combination is defective on its face.

Also, pursuant to MPEP §2143.01, the proposed modification cannot change the principle of operation of a reference. By modifying Imagawa with the teachings of Johnson et al., the principle under which Imagawa was designed to operate (i.e., apparatus to produce steam and use of steam to kill pests) is radically changed by the secondary reference Johnson (i.e., heating outside air and killing pests using heated air). Appellant respectfully submits that there is no known way of incorporating any of the teachings disclosed in Johnson et al. into the Imagawa system without making wholesale changes. A *prima facie* case of obviousness cannot be

established when the primary reference (Imagawa) is a "steam" heating system and the secondary reference (Johnson et al.) discloses a system for heating air because there are simply no common structural features.

Moreover, there is no basis for an expectation of success in the prior art. The Examiner's rejection is also improper because there is no expectation that such a modification to Imagawa would be successful. In order to satisfy the burden of establishing a prime facie case of obviousness, the Examiner must comply with the following standard:

> The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have reasonable likelihood of success, viewed in light of the prior art. Both the suggestion and the expectation of success must be founded in the prior art.

In re Dow Chemical, 837 F.2d, 469, 5 U.S.P.Q. 1529, 1531 (Fed. Cir. 1988) emphasis added, citations omitted).

Johnson et al. does not disclose the use of a "steam generator" or the use of steam as the heat-carrying medium. Johnson's treatment zone is a house or other building. The use of steam within the building would cause the water vapor to condense within the treatment zone and promote mold and other damage (rotting of wood, peeling of wall paper, etc.). In Imagawa, the

use of steam does not have a detrimental effect on the fruit or vegetables, and is likely advantageous because it washes dirt, fertilizer and pesticide residue from the fruits and vegetables. Therefore, the Examiner's combination would make Johnson et al. unfit for its intended purpose.

As mentioned previously, a system utilizing warm or hot air as a medium for carrying the heat does not have to take into consideration the effects of vaporization, boiling points of liquids, condensation and other factors commonly associated with a heating system that utilizes steam. As set forth in *Audel*, a heating system using warm air is classified separately from a heating system utilizing steam; this not only includes the method of producing the medium (furnace for warm air vs. boiler for steam) but how that medium is delivered to the desired location.

Therefore, the combination of Imagawa and Johnson et al. produces no reasonable expectation of success that either reference may be modified by the other and the rejection of the Examiner based on this combination must be reversed.

A system that uses air to heat a space uses ducts and plenums to deliver the hot air. A system that produces steam to heat a space cannot use ducts and plenums because they are not sealed and as the steam travels through the ducts, water would begin to condense on the insides of the ducts and plenums; the condensing water will leak through the various joints and seams of the duct work.

Imagawa and Johnson et al. taken either alone or in combination, simply do not provide the required suggestion or expectation of success. In fact, as set forth above, the combination of Imagawa with Johnson et al. would render Imagawa unsatisfactory for its intended purpose.

Therefore, the Examiner's combination of Imagawa with Johnson et al. is defective on its face and the obviousness rejection of claims 35 and 50 must be reversed pursuant to MPEP §2143.01 and §2143.02.

D) The Examiner's rejection of claims 41 and 45-47 under 35 U.S.C. § 103(a) over Imagawa in view of either U.S. Patent No. 5,965,185 to Bianco or U.S. Patent No. 6,227,002 to Bianco et al. is based on an improper combination

U.S. Patent No. 5,965,185 to Bianco discloses a transportable and size-adjustable apparatus for accelerating the ripening process of produce. The apparatus includes an air-flow control system for transferring air between a high pressure plenum and a low pressure plenum.

U.S. Patent No. 6,227,002 to Bianco et al. discloses an apparatus for transporting and cooling produce. As with the Bianco patent, the Bianco et al. patent includes a refrigeration unit.

The structural differences between the apparatus disclosed in Imagawa and the apparatus disclosed in either Bianco or Bianco et al. are numerous. First, Imagawa heat-treats the produce while Bianco and/or Bianco et al. cools the produce. Second, Imagawa relies on steam to transfer the energy to its chamber, while Bianco and/or Bianco et al. both utilize air. Third, Imagawa's treatment greatly increases the humidity within the chamber, while Bianco and/or Bianco et al. decreases the humidity within their respective chambers. Fourth, Imagawa spot treats the produce once in order to kill pests that may be on the produce. Bianco and/or Bianco et

al. subject the produce to a continuous refrigeration or outside air in order to ripen the produce. The Bianco treatment is continuous until the produce reaches its destination and is not a one-time application. Fifth, Imagawa generates steam and, therefore, requires a continuous connection to water; even if a water tank is connected to the Imagawa apparatus (which is not disclosed or suggested in Imagawa), having to carry the extra weight of water and to constantly refill the water tank would be significant drawbacks to implementing Imagawa in a transportable embodiment. By contrast, the transportability of the apparatus disclosed in either Bianco or Bianco et al. is a primary feature.

Imagawa discloses a system for producing steam to heat-treat produce, while both Bianco patents disclose refrigeration systems that cool air. Replacing Imagawa's boiler with a refrigeration system disclosed in either of the Bianco patents would render Imagawa inoperable. In addition, Imagawa uses steam as the medium to deliver heat to heat-treat produce, while Bianco and/or Bianco et al. use air as the medium to cool produce. Replacing the medium in which the energy is delivered would make Imagawa unfit for its particular purpose.

Imagawa's system, by introducing steam (i.e., water vapor), greatly increases the humidity of the chamber in which the fruit is to be treated while it is well-known to those skilled in the art that air-conditioning/refrigeration, such as that used by the apparatus disclosed in the Bianco and Bianco et al. patents, are designed to reduce the humidity inside their respective chambers. Finally, no where does Imagawa teach or suggest that its chamber is transportable.

Imagawa is designed for a one-time treatment to kill pests. If the produce is continuously exposed to such high temperatures and/or such high humidity for an extended period of time, the produce would spoil preventing it from being consumed – its ultimate purpose.

For any one of the five structural differences described above, the teachings of Imagawa are directly opposite to the teachings of both Bianco patents, the teachings of Imagawa conflict with the teachings of Bianco (and Bianco et al.), the proposed modifications render Imagawa unsatisfactory for its intended purpose, and the proposed modifications change the principles of operation of Imagawa, any one of which is impermissible under MPEP §2143.01. Therefore, the Examiner's combination of Imagawa with Bianco and/or Bianco et al. are improper combinations and the rejection of claims 41 and 45-47 should be reversed.

E) The Examiner's rejection of claim 48 under 35 U.S.C. § 103(a) over Imagawa in view of U.S. Patent No. 3,814,315 to Dmysh is based on an improper combination

U.S. Patent No. 3,814,315 to Dmysh discloses an apparatus for heating air and recirculating the air inside of a cargo trailer. The apparatus is secured to the exterior surface of the trailer via a curved housing and uses a catalytic heater for heating the air.

Again, the structural differences between the apparatus disclosed in Imagawa and the apparatus disclosed in Dmysh are numerous. First, Imagawa uses a steam generator, while Dmysh uses a catalytic heater (a type of portable propane heater). Second, Imagawa relies on steam to transfer the energy to its chamber, while Dmysh utilizes air at the transfer medium.

Third, Imagawa's treatment greatly increases the humidity within the chamber, while Dmysh decreases the humidity within its chamber. Fourth, Imagawa spot treats the produce once in order to kill pests that may be on or in the produce. The Dmysh treatment is continuous until the produce reaches its destination and is not a one-time application. Fifth, Imagawa generates steam and, therefore, requires a continuous connection to water; even if a water tank is connected to the Imagawa apparatus (which is not disclosed or suggested in Imagawa), having to carry the extra weight of water and to constantly refill the water tank would be significant drawbacks to implementing Imagawa in a transportable variation. By contrast, the transportability of the apparatus disclosed in Dmysh is a primary feature.

Nowhere does Imagawa of Dmysh suggest that a steam generator, and a steam system generally, can be successfully modified by a warm-air system utilizing a catalytic heater. Replacing Imagawa's boiler with Dmysh's heater would render Imagawa inoperable.

Imagawa and Dmysh taken in combination, simply do not provide the required suggestion or expectation of success. In fact, the combination of Imagawa with Dmysh would render Imagawa unsatisfactory for its intended purpose, so there can be no motivation or suggestion to make the proposed combination. Therefore, the Examiner's combination of Imagawa with Dmysh is defective on its face and the obviousness rejection of claim 48 must be reversed. (See MPEP §2143.01.)

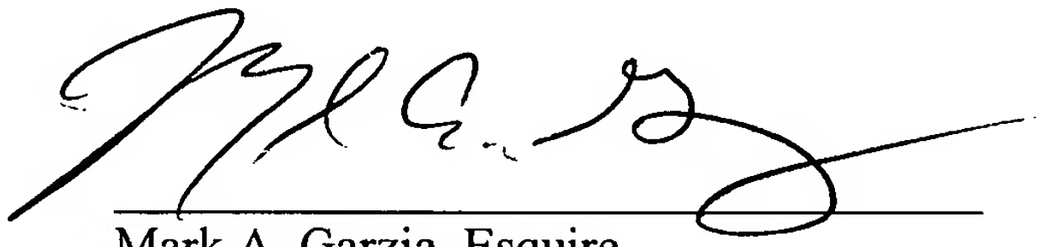
VIII. Conclusion

The differences between the cited art as a whole and the present invention are substantial, and there is no suggestion or motivation in the art made of record which would lead one of ordinary skill in the art to make an apparatus for killing pests as presently claimed. In fact, the cited art teaches away from the present invention and would discourage a person of ordinary skill from proceeding as Appellant has done. Accordingly, all of the Examiner's rejections (under §102 and under §103) based on Imagawa should be reversed thereby prompting the issuance of the Notice of Allowance for claims 32-52.

Respectfully submitted,

Topp Construction Services, Inc.

Date: 5 DECEMBER 2007



Mark A. Garzia, Esquire
Registration No. 35,517
Attorney for Applicant

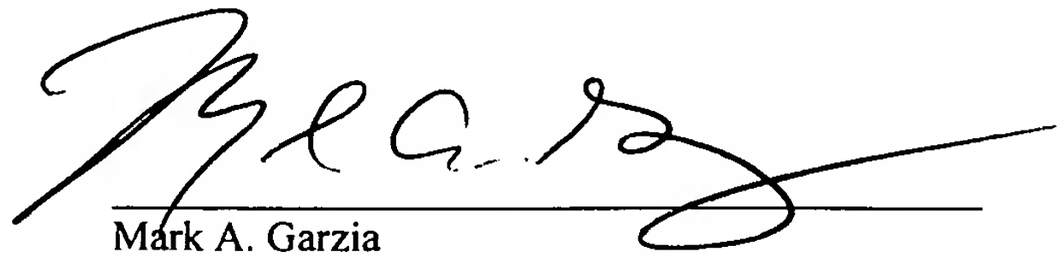
Law Offices of Mark A. Garzia, P.C.
2058 Chichester Ave.
Boothwyn, PA 19061
Telephone: (610) 485-9400

* * * * *

CERTIFICATE OF MAILING

I hereby certify that this Appeal Brief, along with any paper or fee indicated as being enclosed, is being deposited with the United States Postal Service as First Class Mail, postage prepaid, and addressed to the Mail Stop APPEAL BRIEF – PATENTS, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date indicated below.

Date: 5 DECEMBER 2007



Mark A. Garzia

MARK A. GARZIA, P.C.
A PROFESSIONAL CORPORATION

2058 CHICHESTER AVENUE
BOOTHWYN, PA 19061-3735

PATENT, TRADEMARK,
COPYRIGHT AND
RELATED MATTERS

ATTORNEY AT LAW
Admitted in PA and NJ
Registered Patent Attorney

Telephone: 610.485.9400
Facsimile: 610.485.7660
E-mail: mark@patentcounsel.net

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	:	10/651,583
APPLICANT	:	TOPP, Daniel P.
TITLE	:	APPARATUS FOR ERADICATING PESTS
FILING DATE	:	August 29, 2003
CONFIRMATION NO.	:	8842
EXAMINER	:	David J. Parsley
ART UNIT	:	3643
ATTORNEY DOCKET NO.	:	TOPP-P7.1-US
CUSTOMER NO.	:	021616

CLAIMS APPENDIX

Claims 1-31 (Canceled).

32. (Previously Presented): An apparatus for eradicating pests, said apparatus comprising:

a chamber having a first end, a second end, a left wall, a right wall, a ceiling, and a floor, the ceiling and the floor being connected to the ends and walls to define an interior volume of the chamber;

a door that allows ingress to and egress from the interior of the chamber, said door positioned at the first end of the chamber;

a means for heating air in the interior volume of said chamber, said heating means capable of heating said air in said chamber to at least a temperature lethal to pests;

a plenum that communicates with said heating means and said air in the interior volume of said chamber for delivering heated air from the heating means to said interior volume of the chamber, said plenum being formed either internal or external to the chamber;

a means for circulating air in the chamber, said plenum cooperating with said air circulating means for more evenly distributing the air within the interior volume of said chamber; and

a means for returning air from the interior volume of the chamber to said heating means to be heated by the heating means in order to heat-treat any products placed within the chamber to a temperature that is lethal to pests.

33. (Previously Presented) The apparatus of claim 36 wherein said means for returning air comprises a second plenum, said plenum and said second plenum cooperating with each other and with said fan to more evenly circulate the air within the interior of said chamber.

34. (Previously Presented): The apparatus of claim 32 wherein said heater comprises an indirect-fired heating unit.

35. (Previously Presented): The apparatus of claim 32 wherein said heater comprises a direct-fired heating unit.

36. (Previously Presented): The apparatus of claim 32 wherein said means for circulating air comprises a fan assembly utilizing a fan and electric fan motor.

37. (Previously Presented): The apparatus of claim 33 wherein said fan assembly is a duct axial fan.

38. (Previously Presented): The apparatus of claim 33 wherein said floor is reinforced to support the weight of any machinery required to load objects into or unload objects from said chamber.

39. (Previously Presented): The apparatus of claim 33 wherein said heater has an inlet for allowing the second plenum to communicate with the heater thereby directing air into said heater and an output for allowing the plenum to communicate with the heater thereby directing heated air into the interior volume of the chamber to heat said interior volume.

40. (Previously Presented): The apparatus of claim 39 wherein said heater output and input are connected to said plenum and to said second plenum respectively via ducting.

41. (Previously Presented): The apparatus of claim 33 wherein said chamber is a modified trailer having towing means and a tractor wheel assembly attached to the underside of said chamber for facilitating the movement and transportation of said chamber.

42. (Previously Presented): The apparatus of claim 32 further comprising a sub-ceiling wherein said sub-ceiling along with the existing ceiling forms said plenum internal to the chamber.

43. (Previously Presented): The apparatus of claim 42 wherein said means for heating comprises an inlet for allowing outside air to be heated for make-up air as required to pressurize the interior of the chamber.

44. (Previously Presented): An apparatus for eradicating pests that utilizes warm air, said apparatus comprising:

a chamber defining an interior volume, said chamber having means for lifting by external machinery, said chamber having first and second ends;

a door or doors that allows ingress and egress from the interior of the chamber, said doors positioned at the first end of the chamber;

a means for heating air, the air heating means being capable of raising the temperature of the interior of said chamber to a temperature that is lethal to pests, and

a plenum that communicates with said means for heating for assisting in distributing air more evenly throughout the interior volume of said chamber, said plenum and said means for heating being located either exterior to or remotely from said chamber.

45. (Previously Presented): The apparatus of claim 44 wherein said chamber is a refurbished insulated commercial trailer commonly referred to as a reefer box.

46. (Previously Presented): The apparatus of claim 44 further comprising a plurality of wheels that can be mounted on the underside of said chamber in order to move the chamber and facilitate its portability.

47. (Previously Presented): The apparatus of claim 44 further comprising a trailer having wheels, said trailer adapted to be pulled by a tractor truck and that can accept said chamber in order to move the chamber and facilitate its portability.

48. (Previously Presented): The apparatus of claim 44 wherein said chamber is comprised of a modified existing trailer to which said heating device is attached.

49. (Previously Presented): An apparatus for eradicating pests, said apparatus comprising:

a chamber having a first end, a second end, a left wall, a right wall, a ceiling, a sub-ceiling, and a floor, the ceiling and sub-ceiling defining a ceiling plenum;

a door that allows ingress to and egress from the interior of the chamber, said door positioned at one end or each end of the chamber;

a heater having the capacity to heat the air in the interior of said chamber to a desired temperature for a desired period of time, said desired temperature being of sufficient temperature and said desired period of time being of sufficient period so as to be lethal to pests;

the heater having an inlet and an outlet, the outlet of said heater connected directly to said chamber;

means for circulating air having an inlet and an outlet, the outlet of said circulating-air means connected to the inlet of said heater, and the inlet of said circulating air means connected to said ceiling plenum, said ceiling plenum communicating with the interior of the chamber to define a continuous volume for allowing air to be moved by the circulating means through the heater, into the interior of the chamber, through the ceiling plenum and back to the circulating means, said means for circulating, said heating means and said ceiling plenum communicating with each other in order to more evenly heat the interior of said chamber.

50. (Previously Presented): The apparatus of claim 49 wherein said heater and means for circulating are housed in the same unit such as a direct-fired heater.

51. (Previously Presented): The apparatus of claim 49 further comprising a control means for controlling the operation of said heater and said air circulating means so that when a desired temperature and time period are entered into the control means the heater and air circulating means working together draw air from the chamber into said ceiling plenum and

eventually into said air circulating means, said drawn air is then pushed into said heater where it is heated to a predetermined temperature, the heated air then being directed into the floor plenum through the perforated floor and into the chamber, said control means ensuring that the air circulating means and heater operate at least intermittently for the desired period of time in order to keep the air within said chamber and any products placed within the chamber at the desired temperature.

52. (Previously Presented): The apparatus of claim 49 further comprising a primary floor spaced apart from and above the floor of said chamber in order to define a floor plenum, the primary floor comprising a plurality of sections having perforations, said perforations being sized, shaped and spaced in order to communicate with said means for circulating, said heating means and said ceiling plenum to further improve and distribute heat evenly within the interior of said chamber.

MARK A. GARZIA, P.C.
A PROFESSIONAL CORPORATION

2058 CHICHESTER AVENUE
BOOTHWYN, PA 19061-3735

PATENT, TRADEMARK,
COPYRIGHT AND
RELATED MATTERS

ATTORNEY AT LAW
Admitted in PA and NJ
Registered Patent Attorney

Telephone: 610.485.9400
Facsimile: 610.485.7660
E-mail: mark@patentcounsel.net

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	:	10/651,583
APPLICANT	:	TOPP, Daniel P.
TITLE	:	APPARATUS FOR ERADICATING PESTS
FILING DATE	:	August 29, 2003
CONFIRMATION NO.	;	8842
EXAMINER	:	David J. Parsley
ART UNIT	:	3643
ATTORNEY DOCKET NO.	:	TOPP-P7.1-US
CUSTOMER NO.	:	021616

EVIDENCE APPENDIX

This Evidence Appendix has the following items, namely,

EVIDENCE APPENDIX A

Declaration under 37 C.F.R. 1.132 of Jeffrey S. Helmes - 5 pages

This evidence was initially filed with the Reply and Amendment to Final Office Action dated January 13, 2005, which was received and date-stamped by the PTO on January 18, 2005.

The Examiner refused entry of the Reply and Amendment mailed January 13, 2005, because he believed that it raised new issues that would require further consideration and/or search. As a result, the Applicant filed a Request for Continued Examination (RCE) dated

February 14, 2005, which was received by the PTO on February 17, 2005. The Helmes Declaration formed a part of the RCE filing. This Declaration was considered by the Examiner in the Response to Arguments section of the Detailed Action in the non-Final Office Action dated April 14, 2005, which was responsive to the February 17, 2005, communication.

Mr. Helmes cited the Uniform Mechanical Code 2000 - sections 601, 602 and the 1998 International Mechanical Code, Section 602 and 1304 in the aforementioned Declaration. Both references were used by Mr. Helmes to bolster his definition of the term "plenum." However, Applicant was relying on Mr. Helmes' expert opinion of the definition of the term "plenum" as used in the HVAC industry that can be obtained in numerous places – not just in the Uniform Mechanical Code 200 or in the 1998 International Mechanical Code.

EVIDENCE APPENDIX B

Audel HVAC Fundamentals Volume I - Heating Systems, Furnaces, and Boilers, 4th Edition, James E. Brumbaugh, ©2004 by Wiley Publishing, Inc., Indianapolis, IN

Attached hereto are pages 2-3, 16, 18-21, 125, 185, and 273 from *Audel*.

Audel HVAC Fundamentals Volume I was filed/entered into the record in the Reply Pursuant to 37 CFR §1.111 dated October 14, 2005, which was received/date-stamped by the PTO on October 20, 2005 (cited extensively on pages 13-15 of said Reply which portions are reproduced in the attached Brief).

Although the Examiner does not refer to *Audel*, it is believed that the evidence was considered by the Examiner in the Final Office Action dated March 7, 2006, which was responsive to the Reply filed October 14, 2005. As such, it was entered into record at the same time as when *Audel* was entered into the record, namely in Reply to Final Office Action dated October 14, 2005, response to the rejection and objections

James E. Brumbaugh cites the Standard Handbook for Mechanical Engineers in his series titled *Audel HVAC Fundamentals Volumes I, 2 and 3* as a source. Applicant is relying on the expertise of James E. Brumbaugh as conveyed in *Audel* not specifically on the Standard Handbook for mechanical engineers. However, it is important to note that the Standard Handbook is a common book and is easily obtained; moreover, virtually every mechanical engineer either has a copy in their library, required a copy during their college years (both undergraduate and postgraduate), and/or has referred to it at some point in their career.

PATENT, TRADEMARK, COPYRIGHT AND RELATED MATTERS

MARK A. GARZIA, P.C.
A PROFESSIONAL CORPORATION

2058 CHICHESTER AVENUE
BOOTHWYN, PA 19061-3735

Telephone: 610.485.9400
Facsimile: 610.485.7660
E-mail: mark@patentcounsel.net

ATTORNEY AT LAW
Admitted in PA and NJ
Registered Patent Attorney

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT	:	Daniel P. Topp
TITLE	:	APPARATUS FOR ERADICATING PESTS
APPLN. NO.	:	10/651,583
FILING DATE	:	August 29, 2003
EXAMINER	:	David J. Parsley
ART UNIT	:	3643
ATTORNEY DOCKET NO.	:	TOPP-P7.1-US

TO: Mail Stop - AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER CFR § 1.132 OF JEFFREY S. HELMES

Dear Sirs:

I, Jeffrey S. Helmes, hereby declare that:

(A.) I graduated in 1992 from Drexel University (Philadelphia, PA) with a Bachelors of Science degree in Mechanical Engineering. I have been working continuously since 1992 in the mechanical engineering field and since 1996 in the field of HVAC (heating, ventilation & air conditioning). I am currently employed full-time as a Senior Project Engineer at Maguire Products, Inc. in Aston, PA.

(B.) I have studied and am familiar with the above-identified application, the Office Action dated October 13, 2004, and Patent No. 4,716,676 to Imagawa (hereinafter referred to as "Imagawa"). The Examiner alleges that Imagawa teaches the use of plenums and specifically that Imagawa discloses a ceiling and sub-ceiling that forms a plenum. Based on the Examiner's interpretation of Imagawa, he alleges that such features anticipate Applicant's invention.

(C.) Based on my experience in the HVAC (heating, ventilation and air conditioning) industry, it is my opinion that Imagawa does not disclose a plenum as used in the HVAC industry and, in fact, I am unable to discern what the Examiner is calling a sub-ceiling. The Examiner makes broad statements regarding the Figures of Imagawa but does not support his broad statements by referring to specific elements. As an example of the Examiner's lack of locating elements, in Paragraph 4 of the Office Action the Examiner writes "Imagawa discloses an apparatus for eradicating pests comprising, a chamber having a first end, a second end, a left wall, a right wall, a ceiling, sub-ceiling, and a floor – see for example Figure 2 and 6-7, the ceiling and sub-ceiling forming a plenum."

(D.) As will be discussed in the following paragraphs, it is my opinion that:

a) Imagawa does not disclose either a ceiling plenum or a floor plenum;

b) Imagawa discloses the use of hoods; and

c) The teachings of Imagawa regarding the heating of items inside the chamber are contrary to the teachings of the present invention.

(E.) My opinion that Imagawa does not disclose a plenum as the term is used in the HVAC industry is based on a number of factors. First, if Imagawa intends to utilize a plenum, it would have been a simple matter of using the term "plenum." Instead, Imagawa did not use the term plenum anywhere in the specification. Second, the Examiner's description of a "plenum"

as an air-filled space (see paragraph 6 of the Office Action dated October 13, 2004) is overly simplistic and is not the definition of which I am familiar as used in the HVAC industry.

The term "plenum" is well known in the HVAC industry. A "plenum," as used in the HVAC industry, is an enclosed portion of a ventilation system that delivers or receives air from a blower for distribution in a ventilation system. Preferably, a plenum is limited to uninhabited crawl spaces. See *Uniform Mechanical Code 2000*, Sections 601 and 602; and *1998 International Mechanical Code* Sections 602 and 1304.

I cannot find a plenum, as the term is commonly used in the HVAC industry, anywhere in Imagawa. If the Examiner had pointed out specifically with reference numerals what features he believes form a plenum in Imagawa, I could be able to directly dispute the Examiner's interpretation.

(F.) As shown in Figures 1 and 3, Imagawa clearly utilizes a plurality of horizontally positioned hoods 10, 11. Each hood has a blower (10a, 10b, 10c, 11a, 11b, 11c, etc.) associated with it. In addition, Imagawa utilizes a plurality of "insect killing cells B" that include fruit stored in harvest boxes, impenetrable cover members 23, and vertically positioned hoods 21. Each vertically positioned hood 21 includes a differential fan 22 that force steam through the fruit and the harvest boxes. The hoods 21 are connected to a "winding means" 26, 27 that has its own support structures that are permanently affixed inside the chamber but are not labeled. Each insect killing cell B is designed to move over roller conveyors 16 at the bottom of the chamber.

A "duct system" may include ducts, plenums, fans, and accessory air-handling equipment. However, a "plenum" does not include fans, blowers, etc. Accordingly, the hoods 21 and associated fans 22 do not form a plenum and there are no other features in Imagawa that I would consider a "plenum." For example, in Figure 7, a separate inner chamber is permanently

attached inside of the outer chamber A'. The inner chamber has a plurality of ventilation holes in its top and bottom, but there are no plenums as used in the HVAC industry.

(G.) Imagawa expressly states that its system is designed to deliver steam on a large scale to raw fruit. Further, the raw fruit is stacked in neat vertical columns so that each stack can be fitted with a hood.

Even using the Examiner's definition of plenum as an "air-filled space" would not be accurate in describing any volume illustrated in Imagawa since the spaces in Imagawa are filled with steam not air.

In order to prevent condensation of the steam and to meet various building codes, special passages are required. Imagawa requires the use of fitted hoods 21, with special fans 22, and flexible, impenetrable fabric 23. The impenetrable fabric 23 must be flexible so that the differential fan 22 can pull the fabric 23 close to the harvest boxes. (See Imagawa at Column 3, lines 43-54.)

The subject application uses a plenum to ensure that heated air is spread evenly over various items in order to be heat-treated. There are few similarities between a system that delivers steam and one that delivers heated air. To the best of my knowledge, no HVAC plenum is designed to deliver steam. For this reason alone, Imagawa does not disclose a plenum, and its teachings are contrary to the teachings of the subject application.

(H.) I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

Date: 1/11/05

Jeffrey S. Helmes
Senior Project Engineer

AUDEL™

HVAC FUNDAMENTALS

Volume 1: Heating Systems, Furnaces, and Boilers

ALL NEW 4TH EDITION

James E. Brumbaugh

Vice President and Executive Group Publisher: Richard Swadley
Vice President and Executive Publisher: Robert Ipsen
Vice President and Publisher: Joseph B. Wikert
Executive Editorial Director: Mary Bednarek
Editorial Manager: Kathryn A. Malm
Executive Editor: Carol A. Long
Acquisitions Editors: Katie Feltman
Katie Mohr
Senior Production Manager: Fred Bernardi
Development Editor: Kenyon Brown
Production Editor: Vincent Kunkemueller
Text Design & Composition: TechBooks

Published simultaneously in Canada

Library of Congress Cataloging-in-Publication Data:

ISBN: 0-764-54206-0

Printed in the United States of America

10 9 8 7 6 5 4 3 2

the static electricity in the air. Later, adaptations were made by other industries.

Developments in air conditioning technology increased rapidly in the first four decades of the nineteenth century, but widespread use of air conditioning in buildings is a phenomenon of the post-World War II period (i.e., 1945 to the present). Today, air conditioning is found not only in commercial and industrial buildings but in residential dwellings as well. Unlike early forms of air conditioning, which were designed to cool the air or add moisture to it, modern air conditioning systems can control temperature, air moisture content, air cleanliness, and air movement. That is, modern systems *condition* the air rather than simply cool it.

Heating and Ventilating Systems

Many different methods have been devised for heating buildings. Each has its own characteristics, and most methods have at least one objectionable aspect (e.g., high cost of fuel, expensive equipment, or inefficient heating characteristics). Most of these heating methods can be classified according to one of the following four criteria:

1. The heat-conveying medium
2. The fuel used
3. The nature of the heat
4. The efficiency and desirability of the method

The term *heat-conveying medium* means the substance or combination of substances that carries the heat from its point of origin to the area being heated. There are basically four mediums for conveying heat. These four mediums are:

1. Air
2. Water
3. Steam
4. Electricity

Different types of wood, coal, oil, and gas have been used as fuels for producing heat. You may consider electricity as both a fuel and a heat-conveying medium. Each heating fuel has its own characteristics; the advantage of one type over another depends upon such variables as availability, efficiency of the heating equipment (which, in turn, is dependent upon design, maintenance, and other

. Later, adaptations were made by

oning technology increased rapidly
nineteenth century, but widespread
ings is a phenomenon of the post-
to the present). Today, air condi-
mmercial and industrial buildings
ell. Unlike early forms of air condi-
cool the air or add moisture to it,
can control temperature, air mois-
d air movement. That is, modern
han simply cool it.

Systems

en devised for heating buildings.
and most methods have at least
gh cost of fuel, expensive equip-
cteristics). Most of these heating
ing to one of the following four

of the method

m means the substance or com-
the heat from its point of origin
basically four mediums for con-
e:

l, and gas have been used as
nsider electricity as both a fuel
heating fuel has its own char-
e over another depends upon
ıcy of the heating equipment
sign, maintenance, and other

factors), and cost. A detailed analysis of the use and effectiveness of the various heating fuels is found in Chapter 5 ("Heating Fuels").

Heating methods can also be classified with respect to the nature of the heat applied. For example, the heat may be of the exhaust steam variety or it may consist of exhaust gases from internal combustion engines. The nature of the heat applied is inherent to the heat system and can be determined by reading the various chapters that deal with each type of heating system (Chapters 6 through 9) or with heat-producing equipment (e.g., Chapter 11, "Gas Furnaces").

The various heating methods differ considerably in efficiency and desirability. This is due to a number of different but often interrelated factors, such as energy cost, conveying medium employed, and type of heating unit. The integration of these interrelated components into a single operating unit is referred to as a *heating system.*

Because of the different conditions met within practice, there is a great variety in heating systems, but most of them fall into one of the following broad classifications:

1. Warm-air heating system (Chapter 6)
2. Hydronic heating systems (Chapter 7)
3. Steam heating systems (Chapter 8)
4. Electric heating systems (Chapter 9)

You will note that these classifications of heating systems are based on the heat-conveying method used. This is a convenient method of classification because it includes the vast majority of heating systems used today.

As mentioned, ventilating is so closely related to heating in its various applications that the two are very frequently approached as a single subject. In this series, specific aspects of ventilating are considered in Chapter 6 ("Ventilation Principles") and Chapter 7 ("Ventilation and Exhaust Fans") of Volume 3.

The type and design of ventilating system employed depends on a number of different factors, including:

1. Building use or ventilating purpose
2. Size of building
3. Geographical location
4. Heating system used

A residence will have a different ventilating system from a building used for commercial or industrial purposes. Moreover, the

Heat-Conveying Mediums

As mentioned in Chapter 1, several methods are used to classify heating systems. One method is based on the medium that conveys the heat from its source to the point being heated. When the majority of heating systems in use today are examined closely, it can be seen that there are only four basic heat-conveying mediums involved:

1. Air
2. Steam
3. Water
4. Electricity

Air

Air is a gas consisting of a mechanical mixture of 23.2% oxygen (by weight), 75.5% nitrogen, and 1.3% argon with small amounts of other gases. It functions as the heat-conveying medium for warm-air heating systems.

Atmospheric pressure may be defined as the force exerted by the weight of the atmosphere in every point with which it is in contact (Figure 2-8), and is measured in inches of mercury or the corresponding pressure in pounds per square-inch (psi).

The pressure of the atmosphere is approximately 14.7 psi at sea level. The standard atmosphere is 29.921 inches of mercury (in Hg) at 14.696 psi. "Inches of mercury" refers to the height to which the column of mercury in a barometer will remain suspended to balance the pressure caused by the weight of the atmosphere.

Atmospheric pressure varies due to elevation by decreasing approximately ½ lb for every 1000 ft ascent above sea level. Atmospheric pressure in pounds per square-inch is obtained from a barometer reading by multiplying the barometer reading in inches by 0.49116. Examples are given in Table 2-1.

Gauge pressure is pressure whose scale starts at atmospheric pressure. *Absolute pressure,* on the other hand, is pressure measured from true zero or the point of no pressure. When the hand of a steam gauge is at zero, the absolute pressure existing in the boiler is approximately 14.7 psi. Thus, by way of example, 5 lb pressure measured by a steam gauge (i.e., gauge pressure) is equal to 5 lb plus 14.7 lb, or 19.7 psi of absolute pressure.

When air is compressed, both its pressure and temperature are changed in accordance with Boyle's and Charles' laws. According to Robert Boyle (1627–1691), the English philosopher and founder of

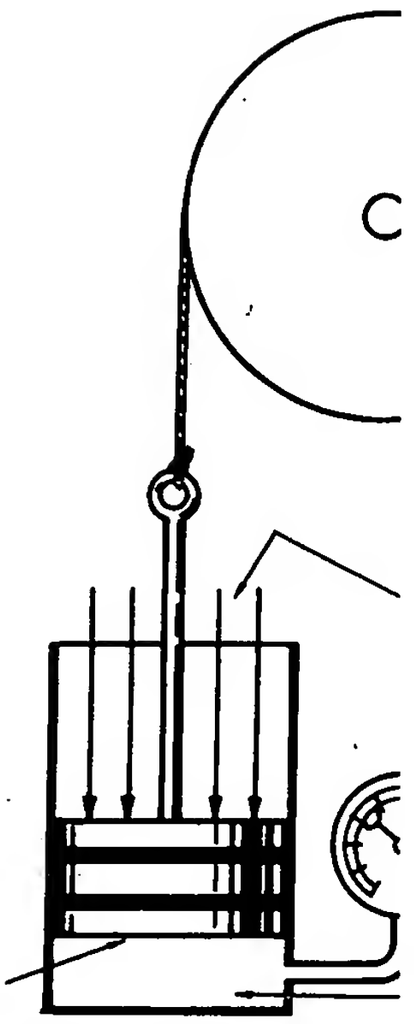


Figure 2-8 Atmospheric

modern chemistry, the ab
ture varies inversely as
established that the volu
temperature when the vo

Table 2-1 Atmo for Vari

Barometer, in Hg	*Pres psi*
28.00	13.7
28.25	13.8
28.50	14.0
28.75	14.1
29.00	14.2
29.25	14.3
29.50	14.4
29.75	14.6

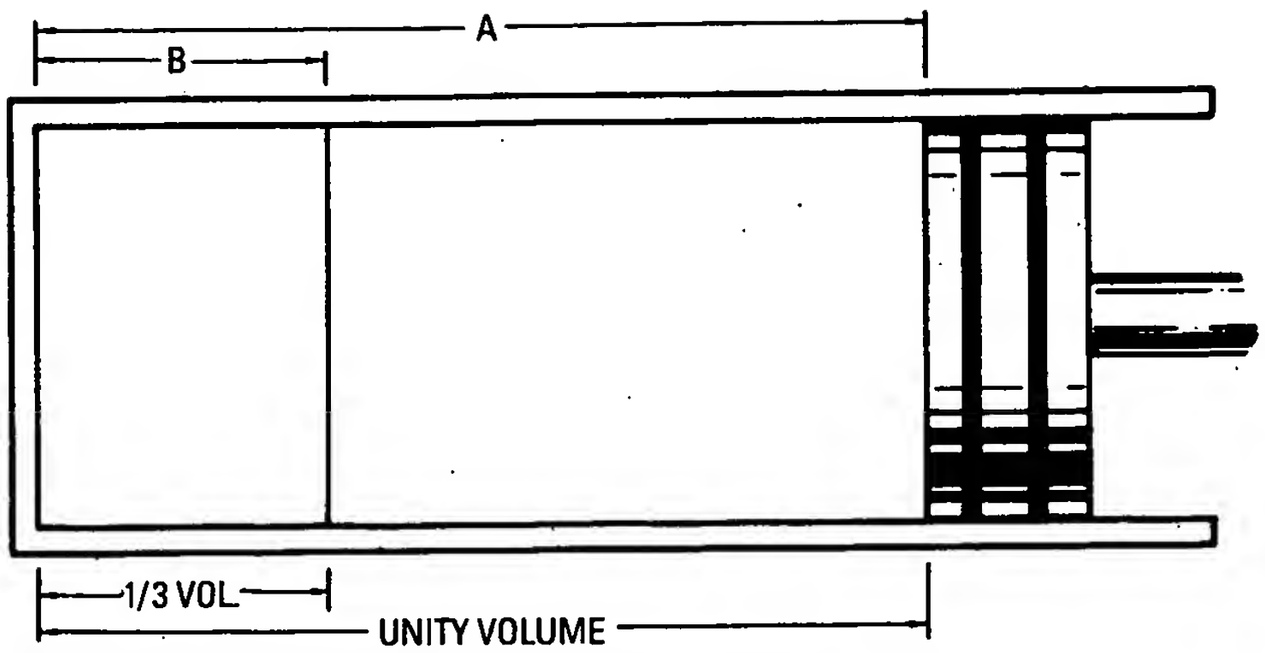


Figure 2-9 Elementary air compressor illustrating the phenomenon of compression as stated in Boyle's and Charles' laws.

If the cylinder in Figure 2-9 is filled with air at atmospheric pressure (14.7 psi absolute), represented by volume A, and the piston B moved to reduce the volume to, say, ⅓ A, as represented by B, then according to Boyle's law, the pressure will be tripled (14.7 × 3 = 44.1 lb absolute, or 44.1 − 14.7 = 29.4 gauge pressure). According to Charles' law, a pressure gauge on the cylinder would at this point indicate a *higher* pressure than 29.4 gauge pressure because of the increase in temperature produced by compressing the air. This is called *adiabatic compression* if no heat is lost or is received externally.

Steam

Those who design, install, or have charge of steam heating plants certainly should have some knowledge of steam and its formation and behavior under various conditions.

Steam is a colorless, expansive, and invisible gas resulting from the vaporization of water. The white cloud associated with steam is a fog of minute liquid particles formed by condensation, that is to say, finely divided condensation. This white cloud is caused by the exposure of the steam to a temperature lower than that corresponding to its pressure.

If the inside of a steam heating main were visible, it would be filled partway with a white cloud; in traversing the main, the little particles combine, forming drops of condensation too heavy to remain in suspension, which accordingly drop to the bottom of the main and drain off as condensation. This condensation flows into

Figure 2-10 Three type

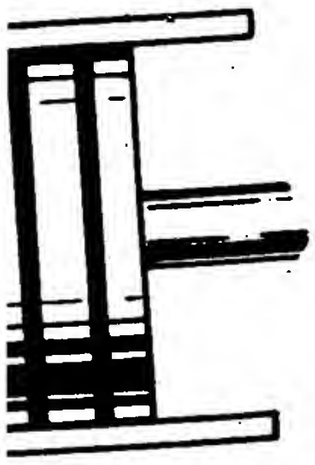
a drop leg of the syste
with additional conden

Although the word "
gas, the five following c

1. Saturated steam
2. Dry steam
3. Wet steam
4. Superheated stean
5. Highly superheate

Three of these clas
heated) are shown in t
Figure 2-10. It should l
nor superheated steam

Saturated steam may
to its pressure. Steam
spray is referred to as *u*



trating the
yle's and

:h air at atmospheric pres-
olume A, and the piston B
, as represented by B, then
ill be tripled (14.7 × 3 =
;auge pressure). According
ylinder would at this point
;auge pressure because of
by compressing the air.
o heat is lost or is received

rge of steam heating plants
of steam and its formation

invisible gas resulting from
)ud associated with steam is
l by condensation, that is to
white cloud is caused by the
ture lower than that corre-

ıin were visible, it would be
:raversing the main, the little
condensation too heavy to
gly drop to the bottom of the
This condensation flows into

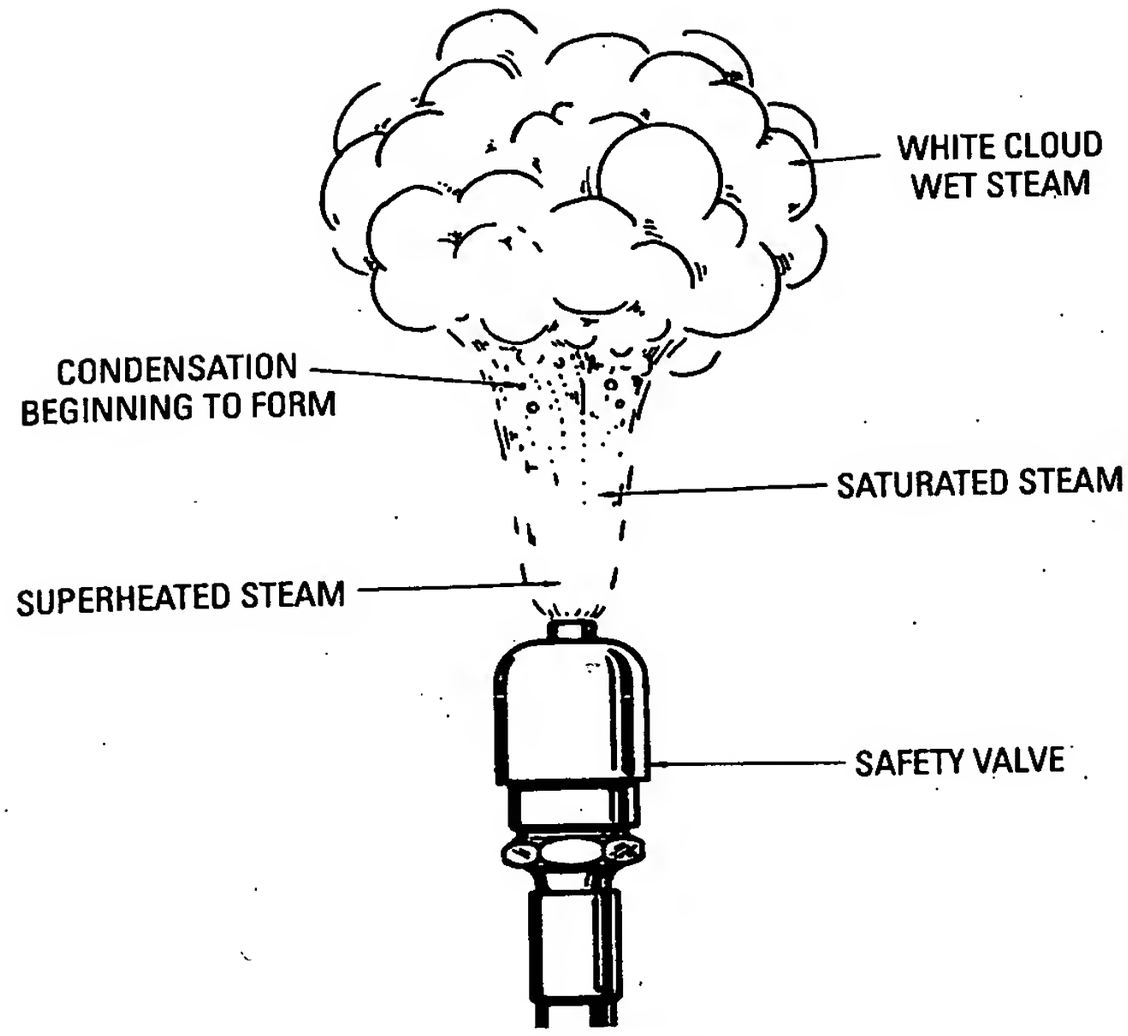


Figure 2-10 Three types of steam.

a drop leg of the system and finally back into the boiler, together with additional condensation draining from the radiators.

Although the word "steam" should be applied only to saturated gas, the five following classes of steam are recognized:

1. Saturated steam
2. Dry steam
3. Wet steam
4. Superheated steam
5. Highly superheated or gaseous steam

Three of these classes of steam (wet, saturated, and superheated) are shown in the illustration of a safety valve blowing in Figure 2-10. It should be pointed out that neither saturated steam nor superheated steam can be seen by the naked eye.

Saturated steam may be defined as steam of a temperature due to its pressure. Steam containing intermingled moisture, mist, or spray is referred to as *wet steam. Dry steam* is steam containing no

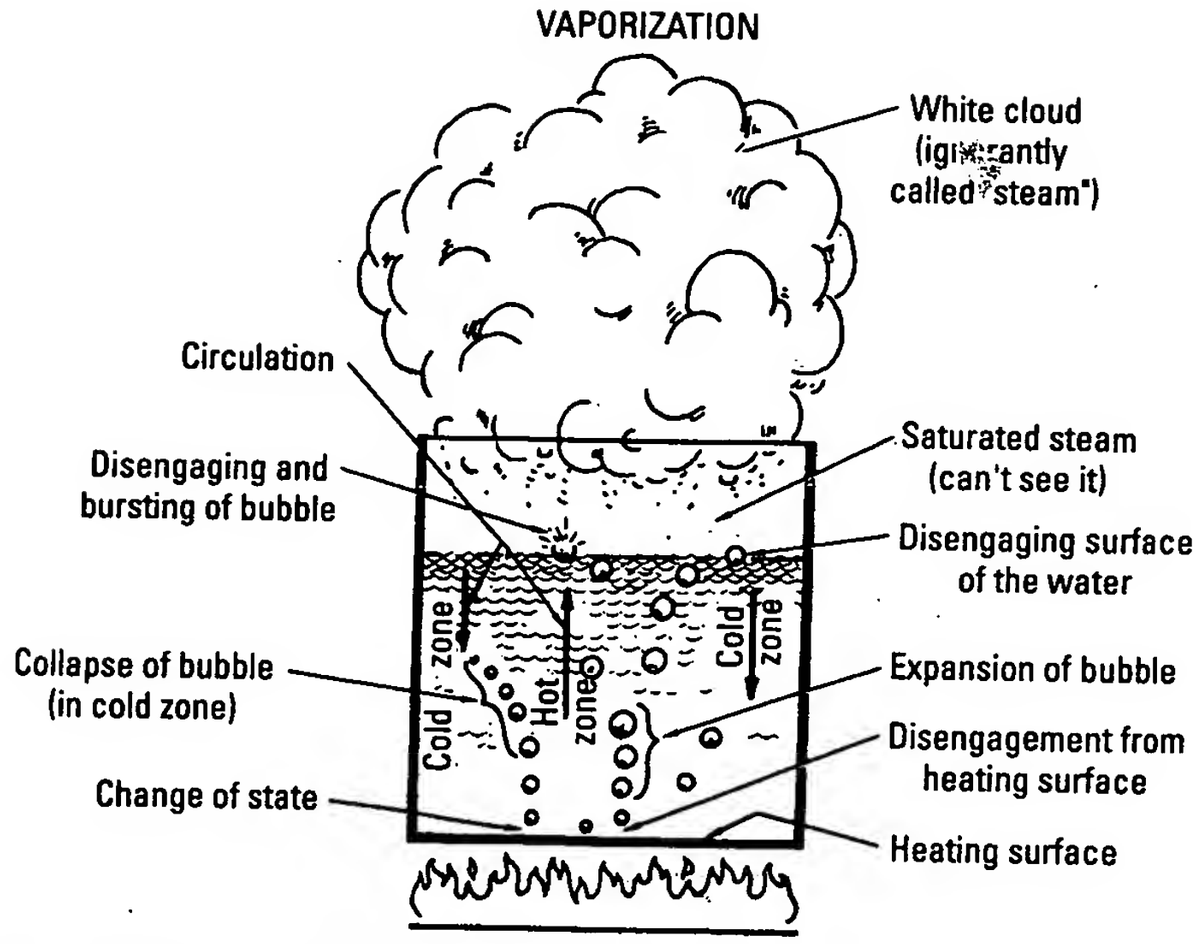


Figure 2-11 The phenomenon of vaporization.

moisture. It may be either saturated or superheated. Finally, *superheated steam* is steam having a temperature higher than that corresponding to its pressure.

The various changes that take place in the making of steam are known as *vaporization* and are shown in Figure 2-11. For the sake of illustration, only one bubble is shown in each receptacle. In actuality there is a continuous procession upward of a great multiplicity of bubbles.

The amount of heat necessary to cause the generation of steam is the sum of the sensible heat, the internal latent heat, and the external latent heat. As mentioned elsewhere in this chapter, sensible heat is the part of the heat that produces a rise in temperature as indicated by the thermometer. The *internal latent heat* is the amount of heat that water will absorb at the boiling point without a change in temperature—that is, before vaporization begins. *External latent heat* is the amount of heat required when vaporization begins to push back the atmosphere and make room for the steam.

Another important factor to consider when dealing with steam is the boiling point of liquids. By definition, the *boiling point* is the

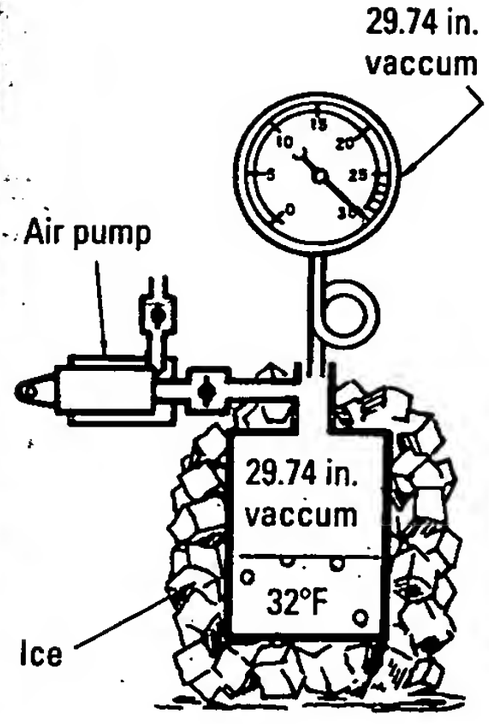


Figure 2.12 Variation o
changes.

temperature at which a
depends upon both the
instance, water boils at
sure of 14.7 psi.

The relationship be
that there is a definite
ing to each value of
closed vessel and there
rise until the equilibriu
established.

One's knowledge of
also include an understa
By definition, *condensa*
gaseous to the liquid (o
by a reduction in tempe
ing to its pressure.

The condensation of s
heating systems unless t
from which the steam w
cally mixed with it, 1/20,
spheric pressure). This ai
not recombine with the c
enced in heating systems
keep it out. Suitable air v

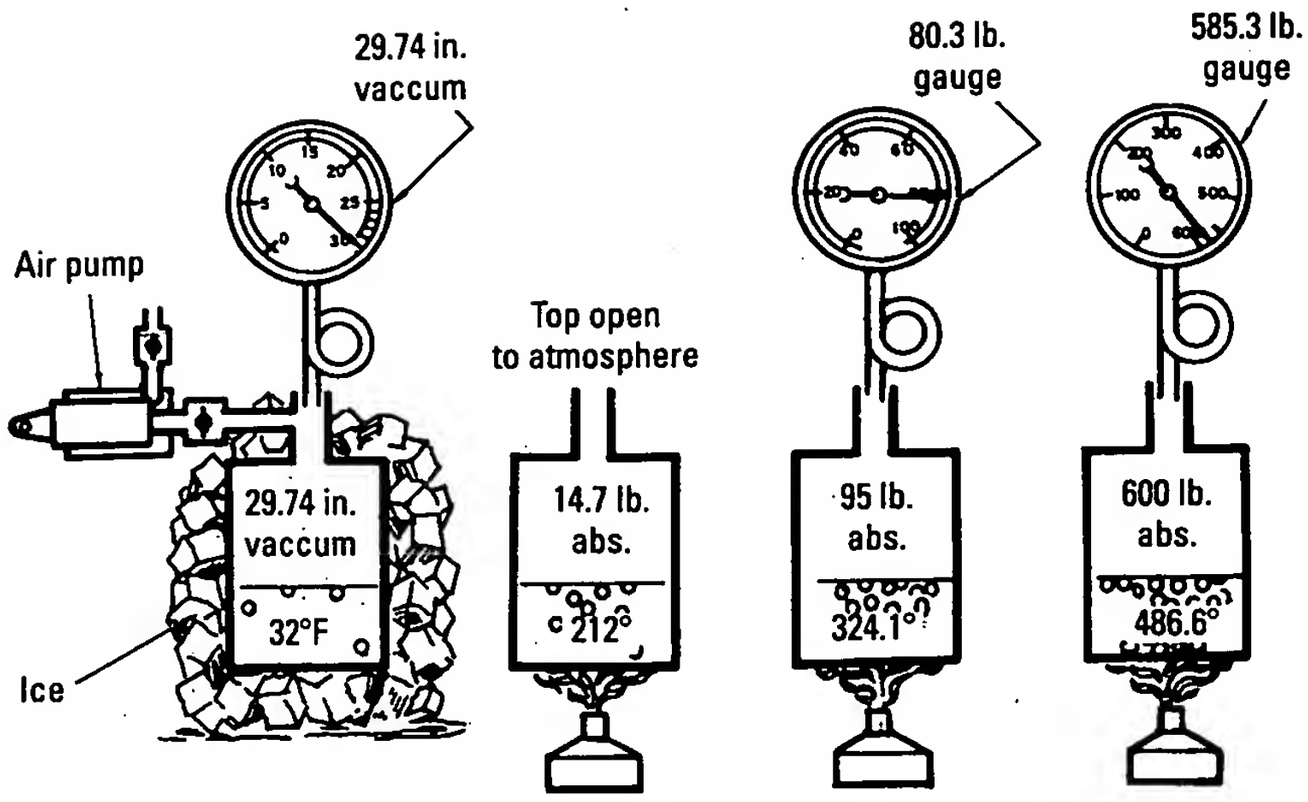


Figure 2.12 Variation of the boiling point when pressure changes.

temperature at which a liquid begins to boil (Figure 2-12), and it depends upon both the pressure and the nature of the liquid. For instance, water boils at 212°F, ether at 9°F, under atmospheric pressure of 14.7 psi.

The relationship between boiling point and pressure is such that there is a definite temperature or boiling point corresponding to each value of pressure. When vaporization occurs in a closed vessel and there is a temperature rise, the pressure will rise until the equilibrium between temperature and pressure is re-established.

One's knowledge of the fundamentals of steam heating should also include an understanding of the role that condensation plays. By definition, *condensation* is the change of a substance from the gaseous to the liquid (or condensate) form. This change is caused by a reduction in temperature of the steam below that corresponding to its pressure.

The condensation of steam can cause certain problems for steam heating systems unless they are designed to allow for it. The water from which the steam was originally formed contained, mechanically mixed with it, 1/20, or 5 percent, of air by volume (at atmospheric pressure). This air is liberated during vaporization and does not recombine with the condensation. As a result, trouble is experienced in heating systems when one attempts to get the air out and keep it out. Suitable air valves are necessary to correct the problem.

nversion Efficiency

	Fuel Efficiency
g	45.0
ıg	60.0
eating	89.0
	80.0
	59.5
eating	97.0
oiler	85.0
tral	78.0
)	99.0
	65.0
)	62.0
	99.0
ng	97.0
ting	200+
mp	300+
ı)	97.0
	30.0–40.0
fans	40.0–70.0
	65.0–75.0
	85.0–90.0

ble Energy/U.S. Department

Chapter 6

Warm-Air Heating Systems

Air is the medium used for conveying heat to the various rooms and spaces within a structure heated by a warm-air furnace. It is also the principal criterion for distinguishing warm-air heating systems from other types in use.

The warm-air furnace is a self-contained and self-enclosed heating unit that is usually (but not always) centrally located in the structure. Depending upon the design, any one of several fuels can be used to fire the furnace. Cool air enters the furnace and is heated as it comes in contact with the hot metal heating surfaces. As the air becomes warmer, it also becomes lighter, which causes it to rise. The warmer, lighter air continues to rise until it is either discharged directly into a room (as in the so-called pipeless gravity system) or carried through a duct system to warm-air outlets located at some distance from the furnace. After the warm air surrenders its heat, it becomes cooler and heavier. Its increased weight causes it to fall back to the furnace, where it is reheated and repeats the cycle. This is a very simplified description of the operating principles involved in warm-air heating, and it especially typifies those involved in gravity heating systems.

Classifying Warm-Air Heating Systems

A *warm-air heating system* is one in which the air is heated in a furnace and circulated through the rest of the structure either by gravity or motor-driven centrifugal fans. If the former is the case, then the system is commonly referred to as a *gravity warm-air heating system.* Any system in which air circulation depends *primarily* on mechanical means for its motive force is called a *forced-warm-air heating system.* The stress on the word "primarily" is intentional because some gravity warm-air systems use fans to supplement gravity flow, and this may prove confusing at first. In any event, one of the oldest forms of classifying warm-air heating systems has been on the basis of which method of air circulation is used: gravity or forced air.

Forced-warm-air heating systems are often classified according to the duct arrangement used. The two basic types of duct arrangements used are:

1. Perimeter duct systems
2. Extended-plenum duct systems

d)

Remedies

eshooting section in
,"Coal Firing Methods"
: 2.
:pair, or replace as

ıt must be set several
gher than the desired
)erature.
vector fins.
eplace as required.
coil according to
ırer's recommended
ce instructions.

Chapter 8

Steam Heating Systems

Steam is a very effective heating medium. Until recently, this property of steam has resulted in its being the most commonly used method of heating residential, commercial, and industrial buildings. Over the past 40 years or so, steam heating has been largely replaced in residences and small buildings by other heating systems that have often proven to be less expensive to install and operate or that operate at similar or greater levels of efficiency in small structures.

The basic operating principles of steam heating are relatively simple. A boiler is used to heat water until it turns to steam. When the steam forms, it rises through the pipes in the heating system to the heat-emitting units (radiators, convectors, etc.) located in the various rooms and spaces in the structure. The metal heat-emitting units, being cooler, cause the steam to condense and return to the boiler in the form of water (condensate, also called *condensation*) for reheating.

Classifying Steam Heating Systems

There are a number of different methods of classifying steam heating systems, but the most commonly used methods include one or more of the following features:

1. Pressure or vacuum conditions
2. Method of condensate flow to the boiler
3. Piping arrangement
4. Type of piping circuit
5. Location of condensate returns

Steam heating systems can be divided into low-pressure and high-pressure types, depending on the operating pressure of the steam used in the system. A *low-pressure system* commonly operates at a pressure of 0 to 15 psig, whereas a *high-pressure system* uses operating pressures in excess of 15 psig.

Both *vapor* and *vacuum steam heating systems* operate at low pressures (0 to 15 psig) and under vacuum conditions. The latter system uses a vacuum pump to maintain the vacuum; the vapor system does not, relying instead on the condensation of the steam to form the vacuum.

Chapter 10

Furnace Fundamentals

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) defines a furnace as "a complete heating unit for transferring heat from fuel being burned to the air supplied to a heating system." The *Standard Handbook for Mechanical Engineers* (Baumeister and Marks, seventh edition) provides a definition that differs only slightly from the one offered by the ASHRAE: "a self-enclosed, fuel-burning unit for heating air by transfer of combustion through metal directly to the air." Contained within these closely similar definitions are the two basic operating principles of a furnace: (1) Some sort of fuel is used to produce combustion, and (2) the heat resulting from this combustion is transferred to the air within the structure. Note that *air*—not steam, water, or some other fluid—is used as the heat-conveying medium. This feature distinguishes warm-air heating systems from the other types; see Chapter 6, "Warm-Air Heating Systems."

Most modern furnaces are used in warm-air heating systems in which the furnace is a centralized unit, and the heat produced in the furnace is forced or rises by means of gravity through a system of ducts or pipes to the various rooms in the structure. This is what one commonly refers to as a *central heating system*. In other words, the furnace is generally in a centralized location within the heating system in order to obtain the most economical and efficient distribution of heat (although this is not an absolute necessity when a forced-warm-air furnace is used).

Ductless or pipeless furnaces are also used in some heating applications but are limited in the size of the area that they can effectively heat. They are installed in the room or area to be heated but are provided with no means for distributing the heat beyond the immediately adjacent area. This is a far less efficient and economical method of heating than the central heating system, but it is found to be adequate for a room, an addition to an existing structure, or a small house or building.

Classifying Furnaces

There are several different ways in which furnaces can be classified. One of the more popular methods is based on the fuel used to fire

MARK A. GARZIA, P.C.
A PROFESSIONAL CORPORATION

2058 CHICHESTER AVENUE
BOOTHWYN, PA 19061-3735

PATENT, TRADEMARK,
COPYRIGHT AND
RELATED MATTERS

ATTORNEY AT LAW
Admitted in PA and NJ
Registered Patent Attorney

Telephone: 610.485.9400
Facsimile: 610.485.7660
E-mail: mark@patentcounsel.net

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	:	10/651,583
APPLICANT	:	TOPP, Daniel P.
TITLE	:	APPARATUS FOR ERADICATING PESTS
FILING DATE	:	August 29, 2003
EXAMINER	:	David J. Parsley
ART UNIT	:	3643
CONFIRMATION NO.	:	8842
ATTORNEY DOCKET NO.	:	TOPP-P7.1-US
CUSTOMER NO.	:	021616

RELATED PROCEEDINGS APPENDIX

NONE